Lekela Egypt

ESIA for Lekela BOO Wind Power Plant at Gulf of Suez

Prepared by:

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May 2018

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1. Introduction

1.1 Background

The Egyptian government is planning to install 4,300MW of renewable energy over the coming three years, the anticipated capacities will be provided from wind power plant as well as PV installations. As part of these plans, the Egyptian New & Renewable Energy Authority (NREA) is planning to establish a wind power plant complex with a total capacity of approximately 2,150 MW near the Red Sea town of Ras Gharib in the Gulf of Suez. The proposed project is in an area of strong wind speeds as shown in chapter 4 of this study.

Energy projects are categorized by Egyptian Environmental Affairs Agency (EEAA) under 'Category C' Projects - which will require a full ESIA including public scoping and consultation activities according to the EIA guidelines issued by EEAA in 2009. However, given that a strategic Environmental and Social Impact Assessment (SESA) for the wind power plant complex has been prepared by NREA, the individual projects will be categorized under the lower EIA level, namely Form B Scoped ESIA. Such project does not require individual stakeholders' consultation and engagement plans.

The project has been tendered to investors and developers to build and operate wind power plants of various capacities on several land plots. The complex comprises 43 land plots to be developed with wind turbines and supply electricity under schemes such as the Feed-in Tariff Scheme (FIT) and the build, own, operate (BOO) scheme. 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 Power is a pan-African renewable energy generation platform developing projects in South Africa, Egypt, Ghana and Senegal and has a portfolio of 1,340MW of projects in development, construction and operation.

Figure (1-1) below shows the location of the project within the regional context.

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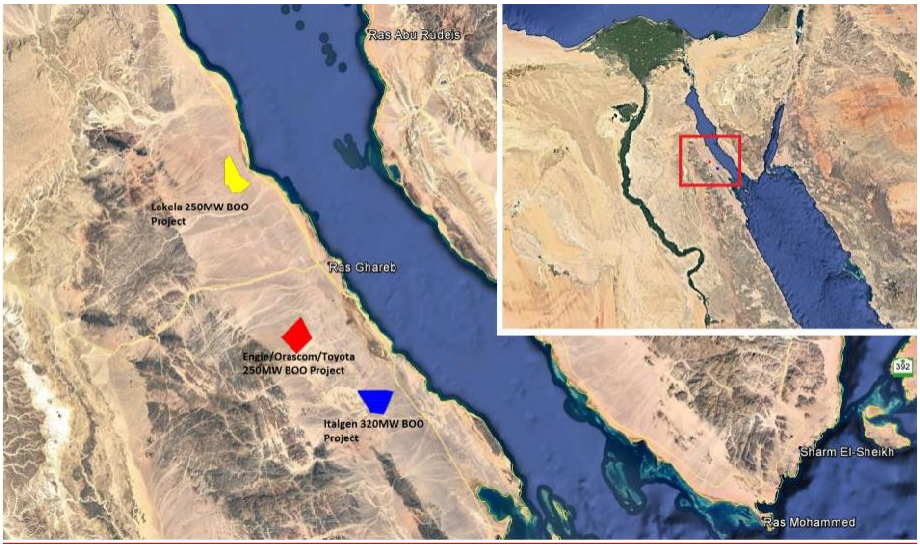

Fig. 1-1 Location of the Lekela BOO within the Regional context

The whole land area for petroleum and wind projects is and will remain the ownership of the Government of Egypt (GoE). The area has been designated for petroleum activities under concession agreements between the GoE and the petroleum companies. The GoE has also assigned the wind park area for NREA for constructing wind farms under the FIT and BOO schemes. The oil concession agreements are related to the underground resources, while the wind farms are above ground.

The area was previously anticipated to be the site of wind FIT projects however due to low demand, some wind FIT plots were not allocated. Five wind FIT plots were subsequently allocated to Lekela for a BOO project. The land was allocated to NREA (an affiliate of the Ministry of Electricity) by presidential decree number 116/2016 in March 2016 (attached translation and another copy of the map from the National Center for Planning State Land Uses). NREA have granted Lekela access to the land to undertake development activities until Financial Close. At Financial Close, Lekela will sign a Usufruct Agreement (lease) with NREA for the life of the project.

The electricity generated from this complex is intended to be connected to the national electricity grid. EETC will be responsible for construction of the required transmission lines and substation to accommodate the generated electricity from all wind power plants and connect to the national electricity grid.

Figure 1-2 below shows the wind power plant complex and the location of Lekela Egypt's plot within the complex.

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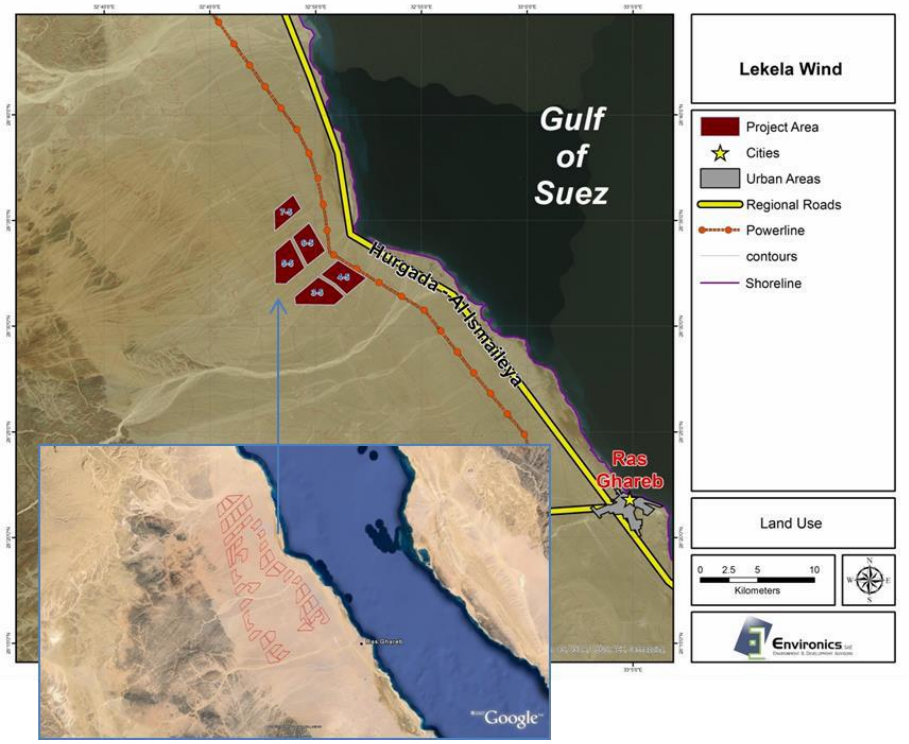

Figure (1-2): The wind power plant complex and the location of Lekela Egypt's project

Plot		Point No.	X	Y	Plot	Point No.	X	Y
P 3-5		1	32°51'21.36"	28°31'25.09"	P 4-5	1	32°52'23.51"	28°32'16.69"
P 3-5		2	32°50'52.99"	28°31'00.69"	P 4-5	2	32°51'27.68"	28°31'30.10"
P 3-5		3	32°49'46.21"	28°31'01.52"	P 4-5	3	32°50'55.22"	28°32'00.36"
P 3-5		4	32°49'02.24"	28°31'02.28"	P 4-5	4	32°50'14.41"	28°32'26.40"
P 3-5		5	32°48'59.93"	28°31'23.66"	P 4-5	5	32°51'03.04"	28°33'06.88"
P 3-5		6	32°50'07.21"	28°32'19.92"	P 4-5	6	32°52'23.51"	28°32'16.69"
P 3-5		7	32°50'48.02"	28°31'54.63"				
P 3-5		8	32°51'21.36"	28°31'25.09"				

Plot		Point No.	X	Y	Plot	Point No.	X	Y
P 5-5		1	32°48'39.76"	28°32'05.42"	P 6-5	1	32°50'27.59"	28°33'34.24"
P 5-5		2	32°48'35.87"	28°32'00.31"	P 6-5	2	32°49'35.66"	28°32'52.74"
P 5-5		3	32°48'04.15"	28°32'01.40"	P 6-5	3	32°49'15.82"	28°33'32.62"
P 5-5		4	32°48'05.23"	28°32'34.97"	P 6-5	4	32°48'54.04"	28°34'14.06"
P 5-5		5	32°48'04.09"	28°33'31.74"	P 6-5	5	32°49'40.61"	28°34'53.50"
P 5-5		6	32°48'47.27"	28°34'08.32"	P 6-5	6	32°50'27.59"	28°33'34.24"
P 5-5		7	32°49'28.78"	28°32'45.13"				
P 5-5		8	32°48'39.76"	28°32'05.42"				

Plot	Point No.	X	Y
P 7-5	1	32°49'18.71"	28°35'33.08"
P 7-5	2	32°48'03.80"	28°34'29.97"
P 7-5	3	32°48'01.88"	28°35'27.91"
P 7-5	4	32°48'55.63"	28°36'13.09"
P 7-5	5	32°49'18.71"	28°35'33.08"

The complex area is mainly desert area and does not include residential or other human activities. ~~However, the BOO area is adjacent to areas where petroleum companies have operational assets~~. The designation of the plots of land for wind farm projects in area appears to minimise the interface with the Petroleum Companies as presented in the figure below.

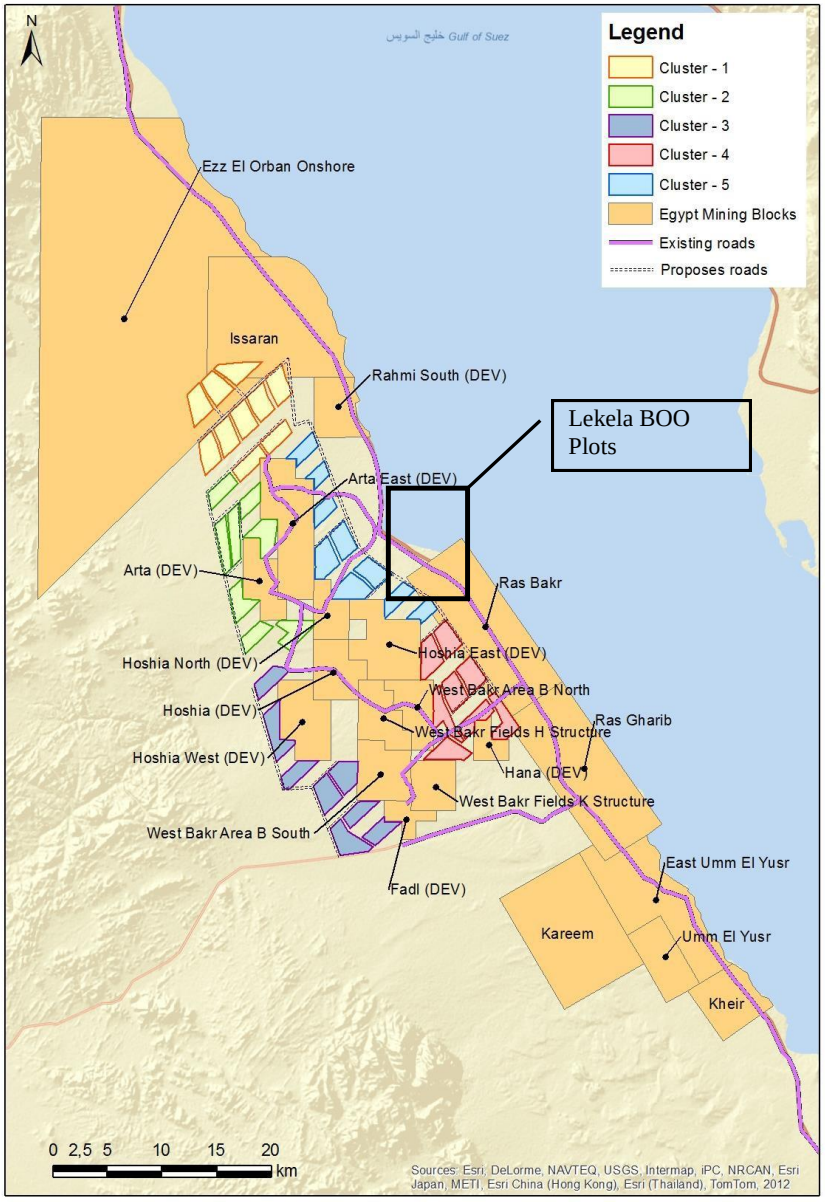

Figure (1-2): Petroleum companies and wind farm plots

The proposed roads shown in Figure (1-2~~Figure (1-2~~) appear to minimize the interface with the Petroleum Companies.

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 considered 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 plant at the different phases of site preparation, construction, startup and operation.

The scope of work covers the specific impacts of the plant within the facility premises, which includes construction, operation and decommissioning of the wind power plant. This ESIA report also includes the results of the pre-construction ornithological monitoring carried out by Lekela as well as the results of the ~~draft~~ SESA report prepared by RCREEE.

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 wind power plant 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 for the wind power plant.

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, the project proponent must prepare an Environmental Impact Assessment (EIA). Accordingly, environmental requirements are integrated into the existing licensing system.

According to the Egyptian Guidelines for EIA (EEAA, 2009), proposed developments are classified to three categories according to the severity of potential impacts. They reflect the increasing level of detail of environmental impact assessment. The three categories are:

- **Category A:** projects with minor environmental impacts
- **Category B Scope:** projects with substantial impacts with specific focus on specific project activities/components
- **Category B:** projects with substantial impacts
- **Category C:** projects with high potential impacts requiring full ESIA

Generally, wind farm projects are categorized by Egyptian Environmental Affairs Agency (EEAA) under „Category C" Projects - which will require a full ESIA including public scoping and consultation activities according to the EIA guidelines issued by EEAA in 2009 as well as the 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), EEAA 2013. However, given that a Strategic Environmental and Social Impact Assessment (SESA) for the wind power plant complex is being carried out by NREA, the individual projects will be categorized under the lower EIA level, namely Form B scoped ESIA. Such projects do not require individual stakeholders" consultation and engagement plans. In this respect, RCREE has organized a public hearing in Hurghada in October 2017 to present the results of the draft SESA.

According to law 4/1994, modified by Law 9/2009, and its executive regulations (ER), the EIA report will be submitted to the Competent Administrative Authority (CAA), under which jurisdiction the project falls. For the wind power plant, the CAA is the New and Renewable Energy Authority (NREA). The CAA would send the EIA to EEAA to issue its response within 30 days. If no response is received beyond this period, the assessment shall be deemed approved.

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) gives the maximum allowable limits for ambient air emissions

For this specific project, the legal stipulations related to the industrial areas apply mainly to potential air emissions during the construction and maintenance phases.

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.

For this specific project, these legal stipulations apply mainly to potential noise levels during the construction and operation phases.

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 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 38/1967 concerning cleanliness and sanitation and its executive regulations (decree 134/1968) regulates the collection, transportation, storage and disposal of solid waste.

For this specific project, these legal stipulations apply mainly to waste generated during the construction and operation phases.

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 reduced 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 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.

For this specific project, the legal stipulations apply to the generation of hazardous waste during construction and operation phase, 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 the 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 addressed the 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
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,
- **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.

2.2.8 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 EIA report will refer to relevant regulations for unlikely 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.

2.2.9 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 construction and operation phase.

2.2.10 Shadowing / flickering from wind turbines

The Egyptian regulations do not address the impacts of shadowing / flickering from wind turbines. According, to the European stipulations (e.g. German emission control law) the limit for affecting residencies by shadowing from wind turbine blades is 30 hours per year and/or 30 minutes per day.

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 Water birds (AEWA), 2015

2.4 Guidelines of the International Financing institutions

In addition to Local Regulations and International Conventions, this ESIA 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: Assessment and Management of Social and Environmental Risks Performance

Standard 1 of the IFC Standards establishes the overarching process of managing social and environmental risks and impacts throughout the life of the project. The major objectives are to identify and evaluate these social and environmental risks; to adopt a mitigation hierarchy that responds to these risks; to ensure communications with external stakeholders are appropriately managed and promoted; and to provide a means for the adequate engagement of affected communities.

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

Performance Standard 2: Labor and Working Conditions
Performance Standard 2 stresses the importance of fostering a good relationship between management and workers with the goal of promoting compliance with national and international employment and labour laws.

This performance requirement applies to the aspects of employment during the different project phases.

Performance Standard 3: Resource Efficiency and Pollution Prevention
This Performance Standard sets out a project-level approach to resource efficiency and pollution prevention that depends on companies taking proactive steps to recognize the environmental impact of their projects. Those that consume natural resources, are required to do so in an efficient manner; while those that emit greenhouse gas emissions are expected to minimize such emissions to the extent that it is cost-effective to do so.

The performance requirement applies to the potential emissions and wastes (solid and liquid) from different sources during construction and operation phases and their potential impacts.

Performance Standard 4: Community Health, Safety and Security
The objective of Performance Standard 4 is to avoid or minimize the risks and impacts on the health, safety and security of affected communities during a project's life-cycle. Broadly, this Standard requires companies to evaluate the risks and impacts of their project on affected communities and to establish controls in accordance with good international industry practice (GIIP) as found in the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines). This evaluation should result in an Action Plan for disclosure to the affected community according to Performance Standard 1. Community engagement requirements are also met in accordance with Performance Standard 1, including the process of free, prior and informed consultation.

The proposed project is a wind power plant and is located within the area designated for NREA to establish wind power plants. The nearest community to the wind farm is Ras Ghareb city at about 25 km south east to the site, thus potential exposure to the outside communities is expected to be insignificant.

Performance Standard 5: Land Acquisition and Involuntary Resettlement
The central objective of Performance Standard 5 is the avoidance or minimization of displacement and to avoid forced eviction. As such, it is concerned with the mitigation of adverse social and economic impacts from land acquisitions as well as the ongoing goal to improve, or restore the standards of living of displaced persons. It also compels companies to consider the loss of access to common property resources and natural resources as an important component of the communitywide evaluation set out in Performance Standard 4.

Provisions of this PS do not apply to the proposed project since the activities will not involve any involuntary resettlement or change in the land use. The project is to be established within a land area where no human settlements are established and no community activities take place. The area has been designated to NREA for establishing the wind farms projects.

Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

The protection and conservation of biodiversity and ecosystem services is paramount to Performance Standard 6. This Standard is applicable to this project with emphasis on collision risks of migratory birds.

As a part of the biological baseline, especially as related to migratory birds, apply to the project and will be addressed in the report with reference to the preliminary results of the ongoing bird monitoring activities.

Performance Standard 7: Indigenous Peoples

Performance Standard 7 is dedicated to the protection of Indigenous Peoples and their communities. It requires companies to avoid adverse project impacts on these communities or to at least minimize and/or compensate Indigenous Peoples through mechanisms tailored to their specific characteristics. The company should establish an ongoing relationship with affected Indigenous communities, and is required to engage in a process of informed consultation and participation. In high risk scenarios, this process will ensure the Free, Prior and Informed Consent (FPCI) of affected peoples.

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

Performance Standard 8: Cultural Heritage

Performance Standard 8 seeks to preserve and protect cultural heritage from the adverse impacts of project activities. Conversely, where projects propose to capitalize on cultural heritage, PS 8 aims to ensure that the benefits flowing from the commercial use of cultural heritage are shared equitably with their communities.

Provisions of this PS do not apply to the proposed project as there are no registered archeological sites within or near the proposed project location. The ESIA will address measures to be adopted in case of chance find

2.5 Health, safety and environment philosophy and policy of Lekela Power B.V.

Lekela Egypt adopts a set of policies for environmental issues and defines and communicates the environment, health and safety standards to their employees and contractors.

The ESG approach is founded upon five key behavioral principles that aim to:

- respect the dignity and well-being of all its people and those with whom the business brings it into contact;
- operate professionally in a performance-orientated culture and be committed to continuous improvement;
- be open and honest in all its dealings, while respecting commercial and personal confidentiality;
- be good corporate citizens, demonstrating integrity in each business and community in which it operates; and
- be objective, consistent and fair with all its stakeholders.

Policies adopted include:

Environmental Policy

– to protect the environment;
– to encourage the efficient use of natural resources; and
– to promote the improvement of the environment wherever possible.

Climate Change Policy

– to minimize the company's contribution to climate change, both from its own direct operational emissions and the indirect emissions of its investee companies; and
– to encourage investment in climate change related sectors.

Health and Safety Policy

– to provide safe and healthy working conditions for company employees;
– to attain safe and healthy working conditions for employees and contractors of all businesses in which the company invests; and
– to safeguard the health and safety of any person who has dealings with the businesses in which the company invests.

Business Integrity Policy

– to exhibit honesty, integrity, fairness and respect in all company business dealings;
– to enhance the good reputation of the company; and
– to manage the company's affairs prudently and with due skill, care and diligence.

Social Policy

– to treat all company employees fairly and to respect their dignity, well-being and diversity;
– to require the businesses in which the company invests to treat all their employees and contractors fairly, and to respect their dignity, wellbeing and diversity;
– to be objective, consistent and fair with all company stakeholders; and
– to work towards full compliance of company investments with the International Labour Organisation Fundamental Conventions and with the UN Declaration of Human Rights.

3. Project Description

3.1 Project Location

Lekela Power is planning to establish a 250 MW wind plant within the wind complex north of Ras Ghareb where NREA has allocated 328 km^2 for generating electricity from wind power. 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 at about 2 km to the East from which it can be accessed as well as the Ras Ghareb – Minya Road to the South. The project area is a desert land and the nearest residential area, the coastal town of Ras Ghareb, is about 28 km to the east of the site. Figure (3-1~~Figure (3-1~~ below shows the activities surrounding the proposed location of the wind plant.

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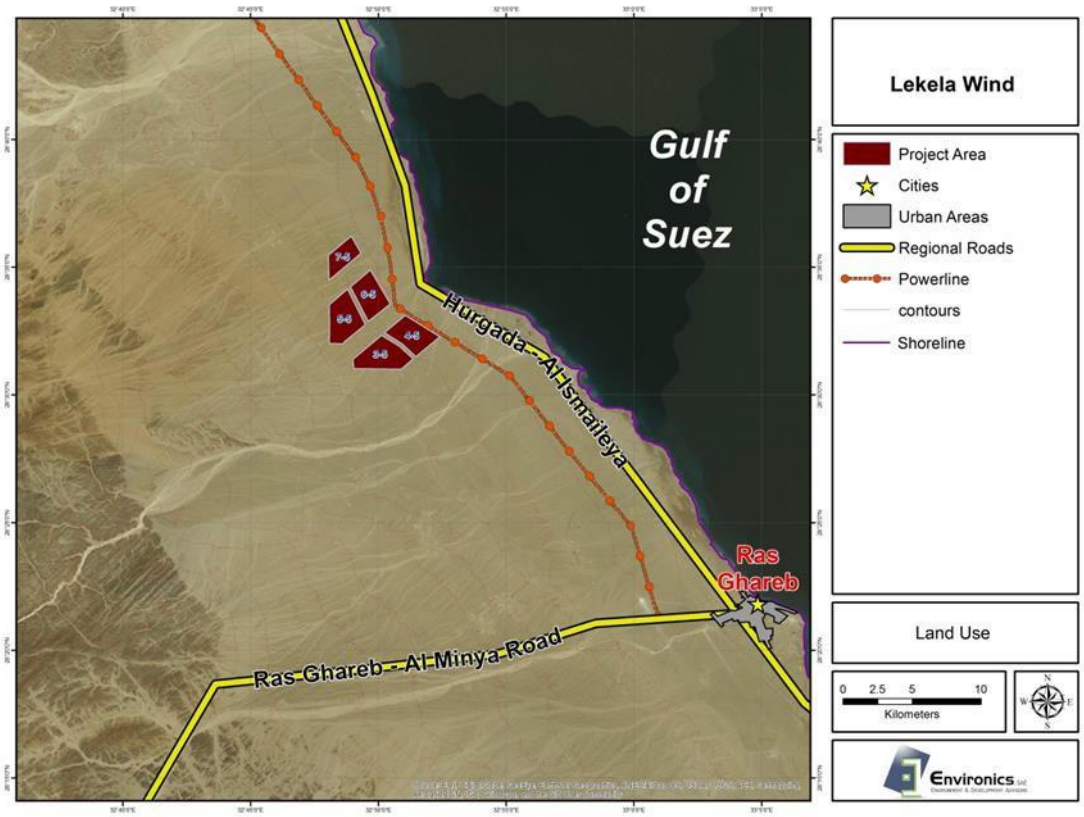

Figure (3-1): The site, neighboring roads and surrounding activities

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. The proposed access roads fall within NREA scope of responsibilities.

NREA will also construct the associated transmission lines to connect Lekela Wind Farm to Egyptian Electricity Transmission Company (EETC) Ras Ghareb Substation 500/220 kV as shown in Figure 3-2 below. 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 in an uninhabited state-owned desert land, where no land acquisition is necessary. The ESIA for the Transmission Line is currently under development.

Figure (3-2): Route of OTL

The site is located south of concession areas of petroleum companies (Petroleum companies have constructed access roads for their operations.

The proposed wind plant will occupy the parcels 3-5, 4-5, 5-5, 6-5 and 7-5. Figure (3-3

~~Figure (3-3~~) shows the location of the project site within the complex.

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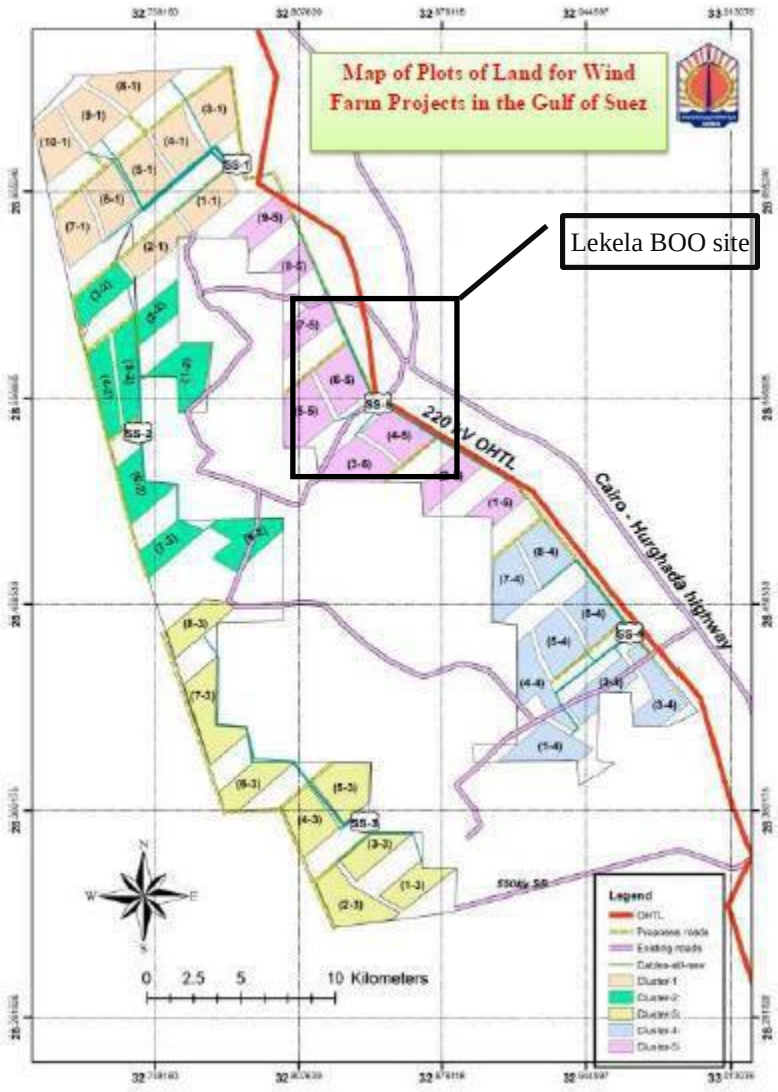

Figure (3-3): Lekela Egypt's Project site

3.2 Process Description

The wind plant comprises between 70 to a 120 independent wind turbine generators (WTGs), appropriately placed and connected in relation to the configuration of the plant.

The main permanent components of the wind farm development are as follows:

- **Wind turbines** and associated foundations;
- **Pad mounted transformers**, most likely located in the WTG tower where the Low Voltage (LV) electricity generated by the WTG is stepped up to Medium Voltage (MV) and routed back to the substation
- **Medium Voltage MV collector system** consists of power cables in underground trenches linking the turbines and connecting them to the on-site electrical control building
- **Fibre optic cable** from the WTG's and earthing is also included in the collector system trenches and routed back to the substation.

- **Site access roads** to enable WTG delivery from main road;
- **Fenced on-site Substation and Control Building and O&M Building;**
- **A crane hard standing adjacent to each turbine to facilitate turbine assembly** and operational maintenance requirements;
- **Three Permanent meteorological masts.**
- **Ancillary equipment.**

The following sections address the process description of the proposed project.

3.2.1 Wind turbines

The WTG consists of rotor blades connected to the hub which is connected to a gearbox and generator as shown below.

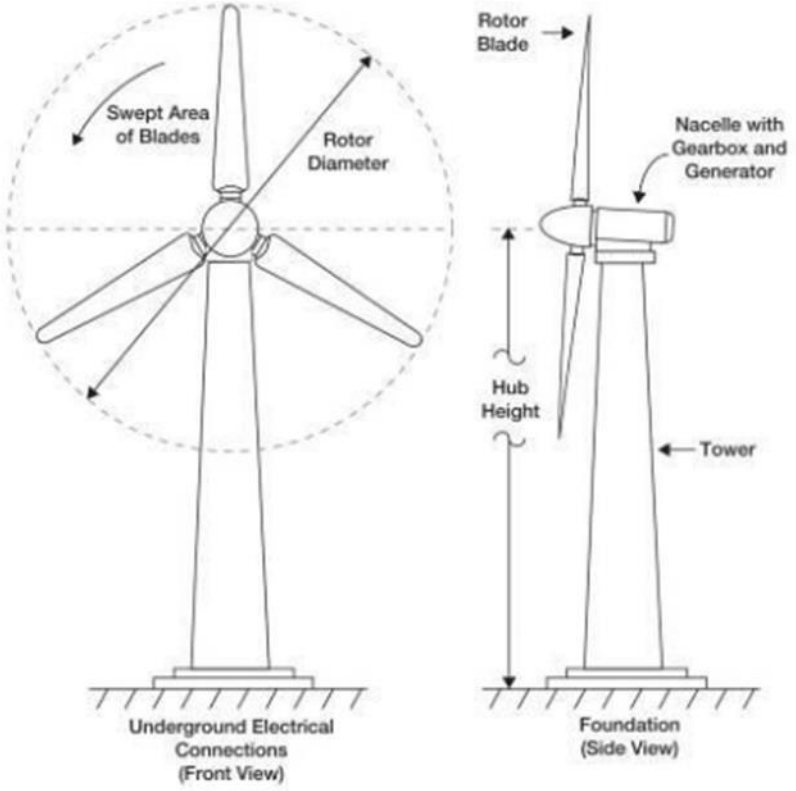

Figure (3-4): Wind turbine components[1]

Two options are being considered for wind turbines; the final turbine layout will depend on the outcome of this feasibility study.

Option one: layout includes 70 turbines rated at 3.6MW. The turbine height will be 120m, the hub height 63m and the rotor diameter 114m. The minimum intra-row separation between turbines is approximately 3.0 rotor diameters (RD). The minimum inter-row separation between adjacent rows of turbines is approximately 8 RD.

[1] Guidelines on the environmental impact assessment for wind farms Belgrade, June 2010. United Nations Development Programme (UNDP) Serbia and Ministry of Environment and Spatial Planning of the Republic of Serbia. https://www.unece.org/fileadmin/DAM/env/eia/documents/EIAguides/Serbia_EIA_windfarms_Jun10_en.pdf

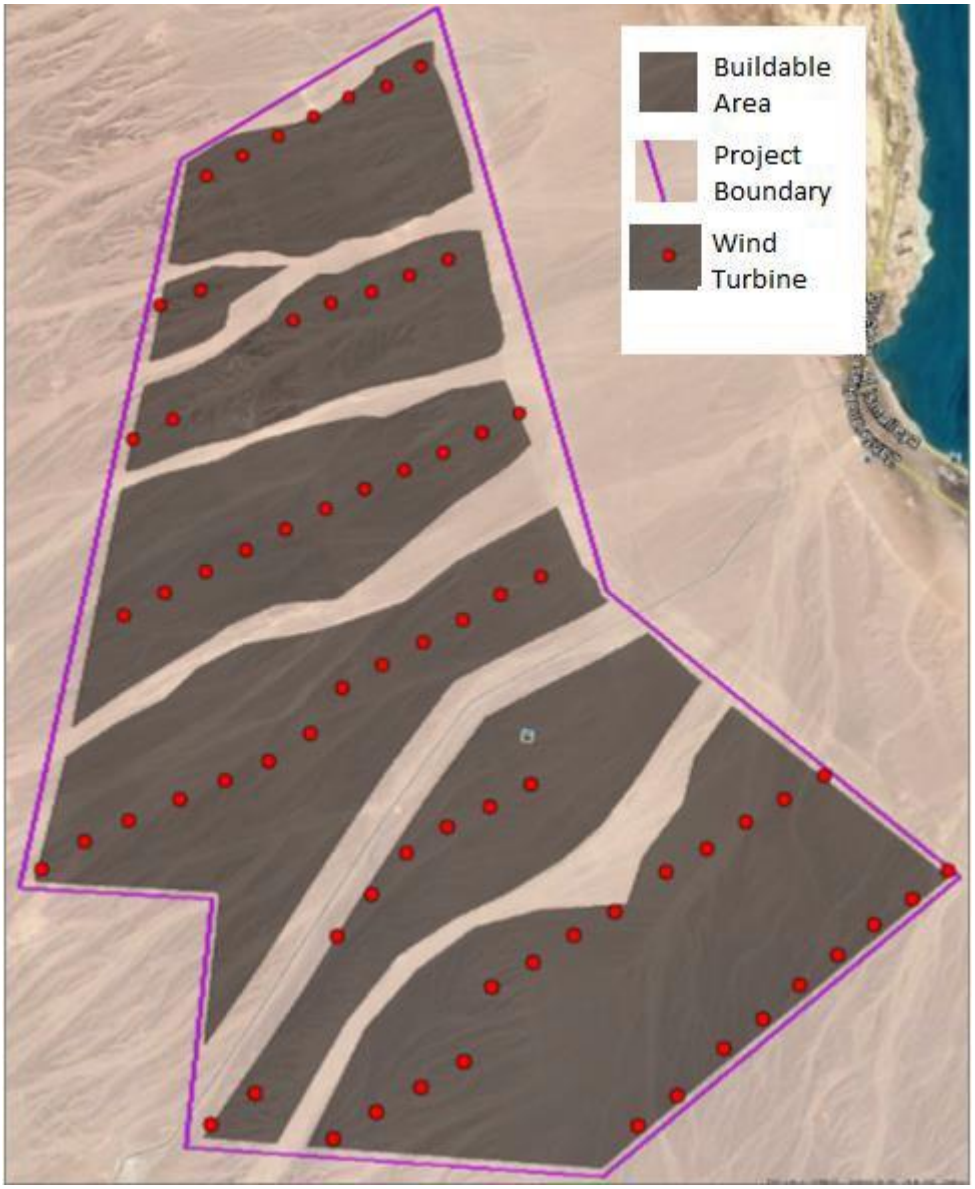

Figure (3-4a): Lekela project layout (70 x 3.6MW option)

Option two: layout includes 120 turbines rated at 2.1MW. The turbine height will be 120m, the hub height 71.5m and the rotor diameter 97m. The minimum distances between wind turbines to be approximately 3.0 rotor diameters (RD). The minimum inter-row separation between adjacent rows of turbines is approximately 8 RD.in the predominant wind direction.

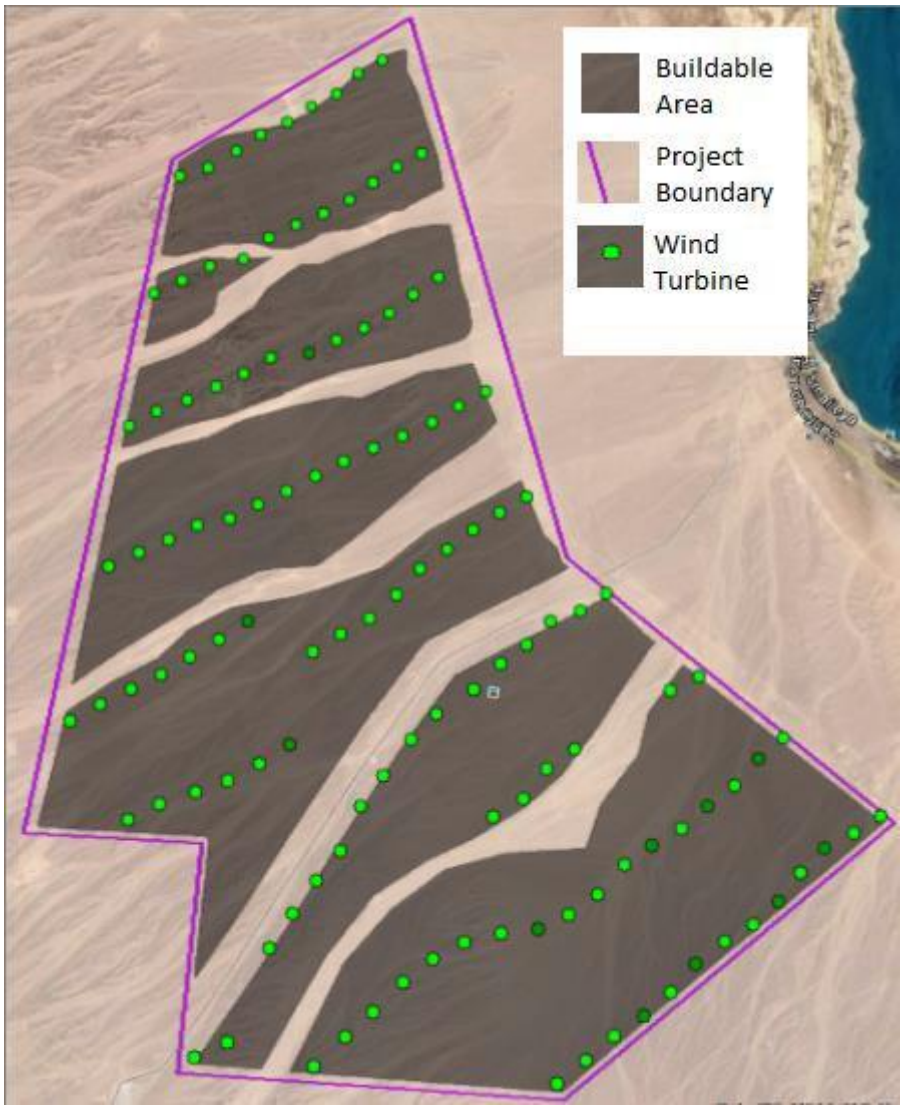

Figure (3-4b): Lekela project layout (120 x 2.1MW option)

Each WTG shall stand on top of a WTG foundation made of approximately 400m^3 of reinforced concrete, the WTG tower that stands on top of the foundation typically consists of three steel sections bolted together to form the overall tower.

The Hub Height is not expected to exceed 80m and will vary depending on the blade length of the selected turbine to ensure that the tip height (the Hub Height plus the blade length) shall not exceed 120m and will comply with the requirements of the Egyptian Military.

3.2.2 Electric Equipment and connection to the grid

The WTGs are connected to form collector circuits that are in turn connected to a new 220kv / MV substation within the site boundary. The HV

side of the step-up transformer at the substation is the electrical boundary limit of the wind farm.

From there, EETC will construct a new 220 kV overhead transmission line of a total length of 30km to connect to a 500kV/ 200kV substation where the voltage is stepped up further and the electrical energy produced is delivered to EETC Transmission System.

Figure (3-5): Substations locations

3.3 Utilities and Infrastructure

The wind plant will entail the construction of the following facilities:

3.3.1 Buildings

- ***Temporary Compound (during construction)***

  For wind farm construction a temporary compound (for storage of materials and servicing of machinery) and a temporary office would be erected at wind farm site. Such temporary facilities will have welfare facilities and a concrete batch plant may also be present.

  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 to all offices including the other parties identified in Section 4 of this document.
- Adequate vehicle parking spaces for up to 40 cars/vans.
- 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, refueling areas.
- Laboratory/testing or holding facilities.

The compound shall be free draining with oil interceptors, or other pollution control measures, as appropriate to protect existing water courses and private water supplies.

- ***Operation***

Buildings will be constructed to accommodate employees and electric infrastructure for operation and maintenance activities.
The O&M Building will be on the BOO site somewhere central and near the entrance.

The O&M building shall include;

- office area (approximate size 100m^2),
- storage area (approximate size 200m^2) with direct external ramp access,
- switchgear room
- bunded area for products containing oil, area for hazardous substances,
- workshop,
- server/communications room,
- meeting room,
- kitchen and eating area,
- mess room,
- changing area/locker area,
- male & female toilets and showers and rest/recreation area all in accordance with relevant legislative requirements.

The O&M 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 required in the substation building for the operational phase including desks, chairs, filing cabinets, shelving for manuals, etc. The O&M Building shall be designed and fitted out such that it is as sustainable as possible.

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

During ensuring that operation assets and personnel are secured and safeguarded in a legitimate manner, Lekela Egypt will ensure sound security measures are undertaken.

3.3.4 Safety equipment

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

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

3.3.5 Permanent meteorological mast

A measurement tower or met mast is a free-standing tower or a removed mast, which carries measuring instruments with meteorological instruments such as thermometers and wind velocity measurers. Up to three meteorological masts/ measurement towers will be installed to carry measuring instruments.

3.4 Construction Activities

3.4.1 Main Activities and Schedule

Site construction works are expected to take up to approximately 22months.

The project will be constructed under an EPC (Engineering, Procure and Construct) agreement or a multi contract approach where the construction contracts are split between the turbine supplier and the balance of plant (BOP) contractor.

The BOP contractor shall complete the civil and electrical works (site roads, foundations, hardstands and medium voltage collection circuit, unit transformers and control building etc).

The Turbine Supplier shall supply, install and commission the WTGs to the project.

Activities during the construction phase would include:

- Extraction/importation of aggregate for access track, hard-standing and turbine base construction[2];
- Construction of temporary office facilities;
- Construction of access tracks;
- Construction of turbine foundations and crane hard-standings;
- Necessary tests for soil and concrete
- Construction of meteorological masts, substation and O&M building Excavation of trenches and cable laying adjacent to site tracks;
- Connection of collector system cabling;
- Supply and installation of wind turbines;
- Commissioning of site equipment; and
- Site restoration.

Foundation– Steel fixing stage.

Foundation concrete pour completed and ready for backfilling.

Nacelle Lift

Rotor Lift: crane supporting blade tip until necessary ground clearance is achieved.

Figure 3-6): Turbine installation process

[2] A manoeuvre zone (crane pad or hardstand) is planned to be constructed next to every wind turbine. These are required to place cranes and trailers used to lift and assembly the wind turbine.
The hardstands for the wind turbines will be designed according to the manufacturer specifications, set by the vehicles dimensions, its maneuverability and the free area needed for materials storage.

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 300 workers at peak construction stage, including skilled and unskilled persons. The company 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 usually via tankers from the Hurghada – Ras Gharib water pipeline. An on-site water tank will be installed to provide potable water to the construction operations.

For concreting works

For concreting works related to the foundations and the substation much more water might be required, if the concrete will not be provided as ready mix.

In case of having a batching plant at the site, the water will have to be provided by tankers.

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

Table (3-1): Estimated Water consumption[3]

Activity	Maximum water requirement
WTG foundation pouring	50 m^3 per WTG foundation, as it is assumed that the size of the foundation is about 400 m^3
WTG foundation curing	1 m^3 per foundation per day, as it Is assumed that 10 days will be sufficient for foundation curing
WTG components cleaning before erection	2 m^3 per wind turbine

- ***Power Source***

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

[3] Based on SESA 2017 estimates

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, aluminum, 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 the 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. Lekela Egypt will store, pack and label hazardous wastes according to valid national legislation and remove hazardous waste through authorized waste management officers.

  Potential hazardous wastes from the project will finally be disposed of through Petrotrade Company[4].

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 approximately 12.

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

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 to provide potable water to the buildings. The daily consumption is expected to be 50 liter/ person per day.

- ***Power Source***

Lekela Egypt's power system is such that part of the generated energy will be directed to the lighting system and buildings. An auxiliary import connection or back-up diesel generator will also be utilized during operation.

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 the approved sites or safe waste disposal site. Lekela Egypt 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. These will be temporarily stored in designated area inside tightly closed barrels and finally disposed through Petrotrade Company.

4. Introduction

The baseline aims to provide description 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 mainly based on a desk study and on field visits carried out during the period 9-10 November and on 16 November 2015 as well as recent visits to the area in 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 specialist studies of the study area carried out by Environics in 2014 (Environics, 2014a; 2014b; 2014c) and Kina the Socio-economic Advisory (2018), in addition to the results of the stakeholders public meeting conducted as part of the ESIA preparation in April 2018. 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.

Data and information related to the socioeconomic aspects was mainly based on desk study and on publicly accessible data sources such as Central Agency for Public Mobilization and Statistics (CAPMAS), as well as previous specialist studies of the study area carried out by Environics in 2014 (Environics, 2014a; 2014b; 2014c) and the report prepared by Kina The Socio-economic Advisory (2018), in addition to the results of the stakeholders public meeting conducted as part of the ESIA preparation in April 2018.

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 Lekela Egypt 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. In this context, to address project's potential vulnerability to climate change, Lekela has prepared a climate resilience assessment report attached in Annex (1) of this report.

Comment [A1]: please attached the resilience report.

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 Egypt's project documents, the wind data (Figure (4-1~~Figure (1-1~~), Figure (4-2~~Figure (1-2~~)) are based on data measured at 80m height within 40km of the site, and have been verified using MERRA reanalysis data from NASA.

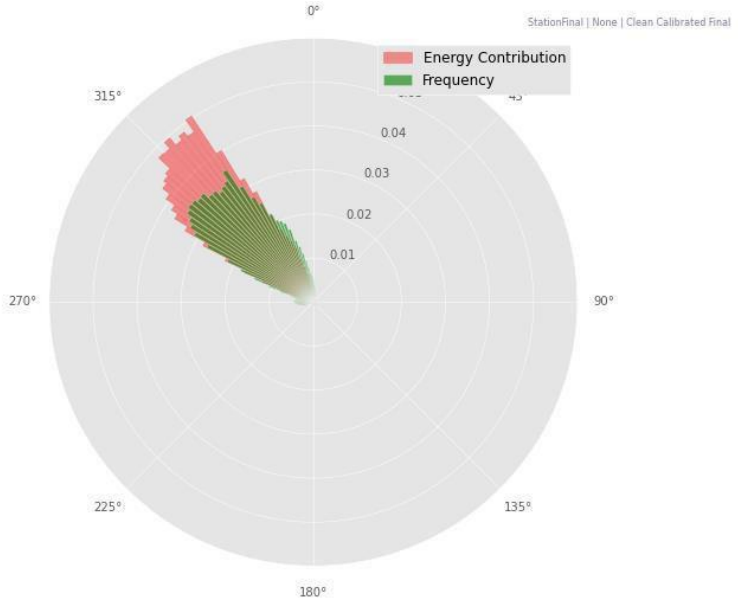

Figure (4-1): Wind Rose
Source: Lekela Project documents

The monthly wind speed variations are shown below.

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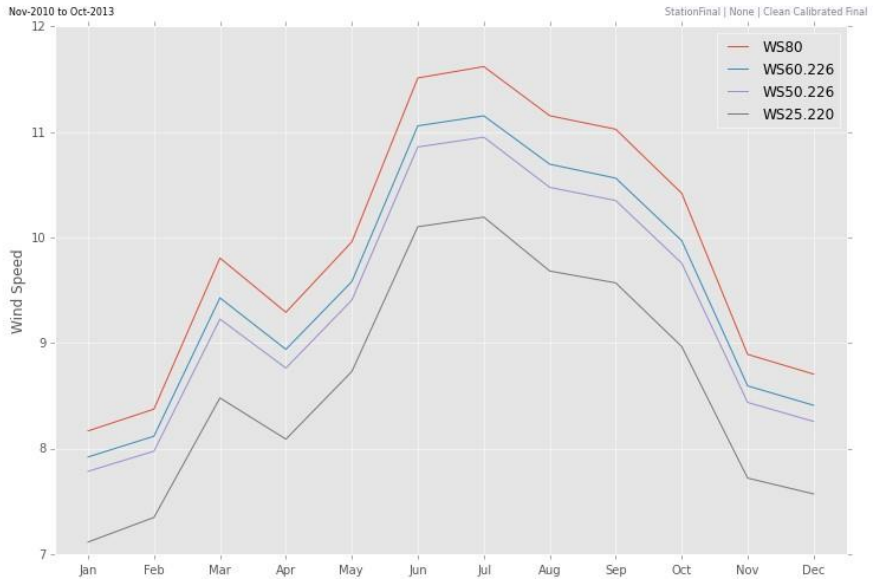

Figure (4-2): Wind Speed Variations
Source: Lekela Project documents

4.1.2 Air Quality

There are no emissions 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 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 about 4km.

The area includes petroleum concessions areas assigned for petroleum explorations where the activities currently being performed include seismic investigations, exploration as well as development and production activities. No air emission sources from such activities are currently present in the direct vicinity of the Lekela project, as drilling and production are at least 5 km north and west of the Lekela site. No flaring takes place in these locations, given the very low gas to oil ratio in the reservoir[1].

[1] Personal communication with West Bakr HSE manager

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 for reasons of lack of man-made noise emission sources and of sensitive receptors in and around the project site (NREA, 2013). There is no temporary/informal residence near the project site. The nearest residential cluster is in Ras Ghareb at more than 25km from the site.

The existing sources of noise potentially result from natural ambient noise level in the project area resulting from high winds speeds occurring frequently. There is very few traffic on the asphalt road to the east.

Such punctual noise emissions of 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 decrease 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)~~ below.

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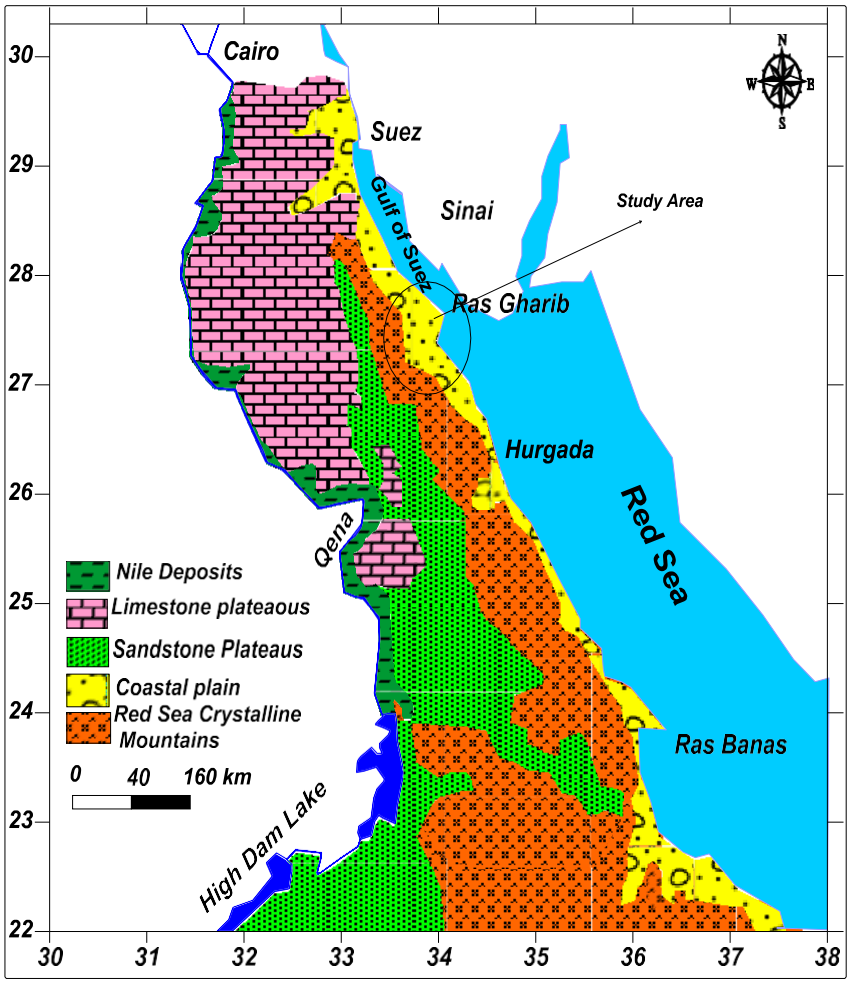

Figure (4-3): General Geomorphology of Eastern Desert

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~~Figure (4-4~~**). The project site is 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, composed of conglomerate sands and coral limestone.

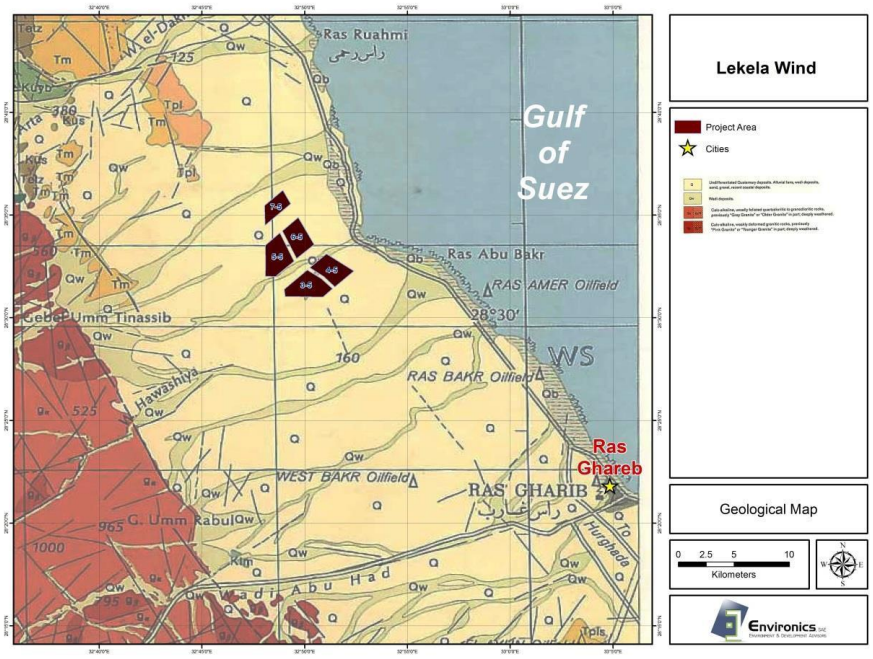

Figure (4-4): Geological map of the study area (extracted from the Geological Map of Egypt)

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~~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
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	
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	

a. Flood Hazard

Flood hazard is the risk associated with flooding of an area. It 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 wind farm area, a preliminary flood intensity mapping presented in Figure (4-5~~Figure (4-5~~) was inferred from a previous hydrological study of the area (Environics, 2014a). It is noted that the project site is not intersected by a flood stream, but lies close to stream to its northern and southern boundaries.

Most of Egypt is a desert and is classified as arid (except for the Mediterranean coast, which is semi-arid. Given lack of precipitation data, there is low statistical confidence regarding historical trends2. Although the results of some of the models could show an increase in total precipitation on the national level (include reference). Across Global Climate Models (GCMs) there is a consistent tilt (which does not mean a higher probability, though) towards a decrease in mean precipitation with climate change for Egypt, but that wet extremes could increase[2,3].

[2] Climate Change Information Fact Sheet, EGYPT- USAID, September 2015

[3] Climate: Observations, projections and impacts: Egypt – Department of Energy and Climate Change - Met Office, UK, 2011

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Although little has been published specifically on the impact of climate change on pluvial flooding for Egypt[4], it is known that short intense precipitation events are more likely to cause flooding. However, this possible increase in flood intensity is not accompanied by a change in flood paths, and catchment areas (as these will require a change in topography, unlikely to result from natural causes). The intensity is generally low and catchment area limited as per the ESIA. As discussed, Lekela's hydrological studies have considered flooding conditions that occur under periods of intense rainfall and appropriate mitigation has been proposed.

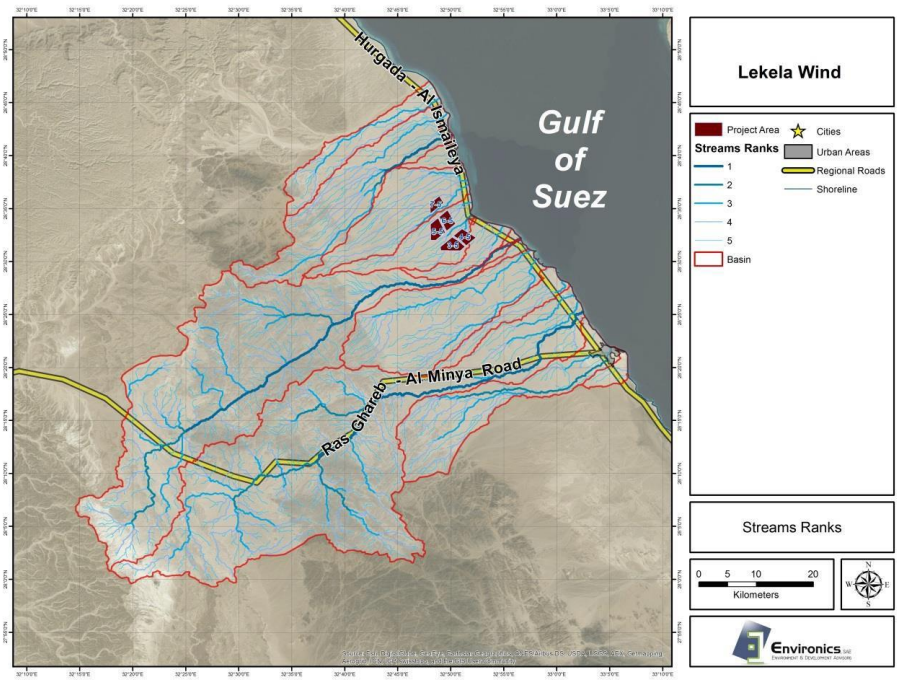

Figure (4-5): Drainage basin streams ranking

b. Flood risk

Probability rating of flooding in each basin is done by considering certain causative factors. The causative factors considered 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~~Figure (4-6~~). According to the inferred map the flood risk for the project site falls in a medium risk zone, but very

[4] Ibid 2

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close to a high-risk zone of a limited surface area.

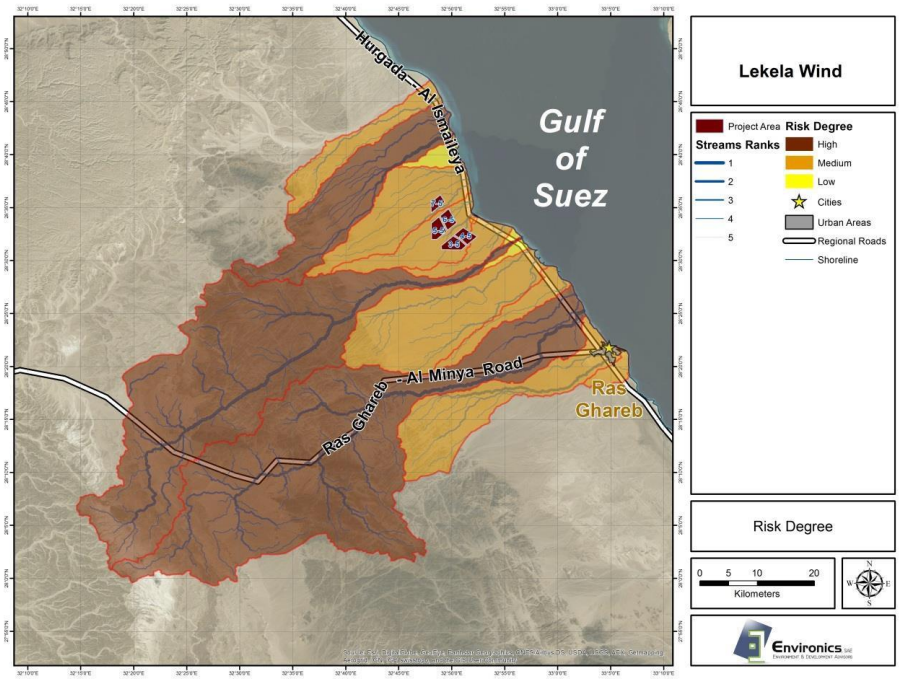

Figure (4-6): Flood risk map for the project site and wider area

c. 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 project site is in an area of low flood intensity streams Figure (4-7~~Figure (4-7~~).

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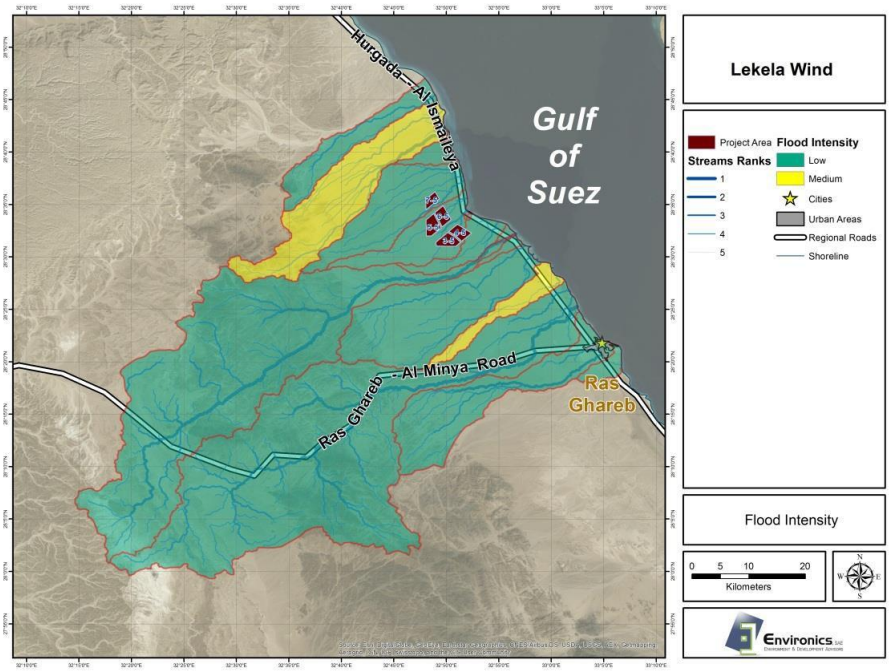

Figure (4-7): Flood Intensity map for the project site and wider area

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 is large and hence the runoff depth and velocity will be small. Moreover, the low flood intensity does not mean that the study area is safe against flash floods.

In conclusion, the project area falls in an area of low intensity and medium risk. Accordingly, in terms of hazards, the potential floods are not of a destructive nature.

4.1.7 Groundwater Hydrology

a. Hydrogeological Units

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 67 km south of the Lekela Egypt 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 meters. 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 hydro chemical feature 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 *et al*., 2003) as shown in Figure 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.

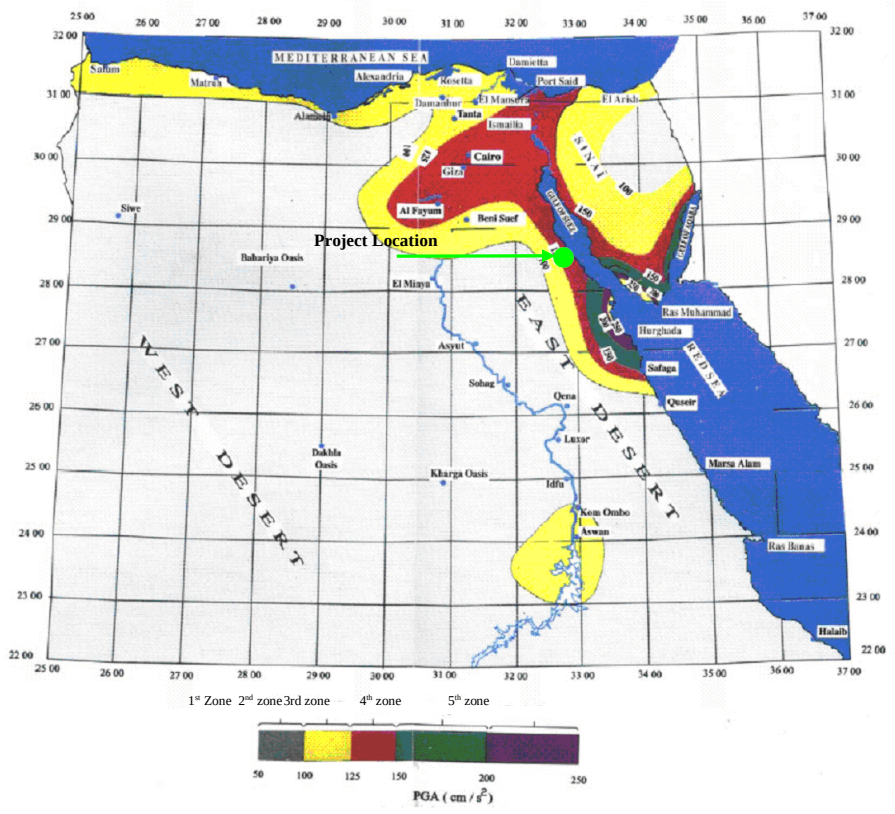

Figure (4-8): Earthquake Zones

4.2 Biological Environment

This section provides description of the biological environment within the project wider area (section 1.2.1) and focuses on the project area, including the specific project site and its immediate surroundings (section 1.2.2).

4.2.1 Ecology of the Wider Area

This section is based on literature review, field surveys carried out by NREA (2013) and Environics (2014c) during the period 4-7 August 2014[5], the wider area is covering 1330 km2 which is mainly 3 petroleum concessions as shown in the figure below.

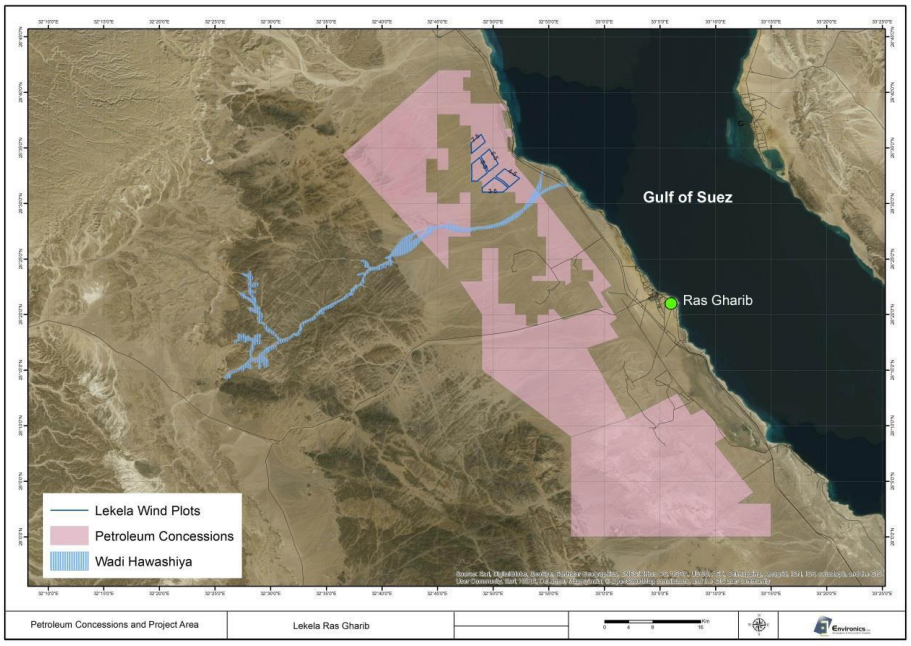

Figure (4-9): The wider area of the project

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 (4-10~~Figure (4-10~~). These are the coastal mountains, the desert coastal plain and the littoral belt that includes coastal salt marshes.

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[5] 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.

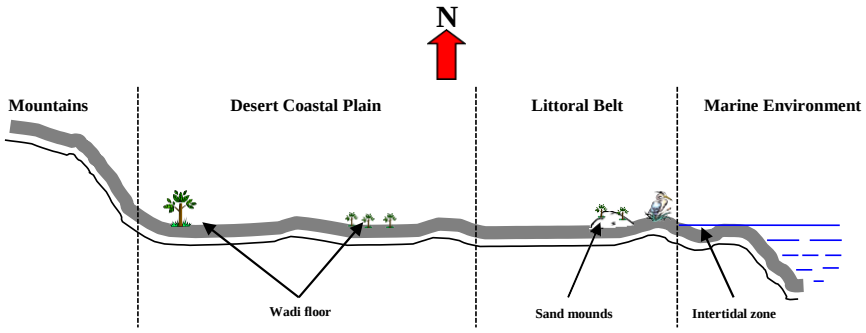

Figure (4-10): Schematic representation of the ecological zones of the study area

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 (4-11~~Figure (4-11~~), to represent the vegetation physiognomy and the different habitats of the study area.

Although the Lekela Egypt site lies within the concession, no survey stands were placed in this site due to the absence of vegetation cover.

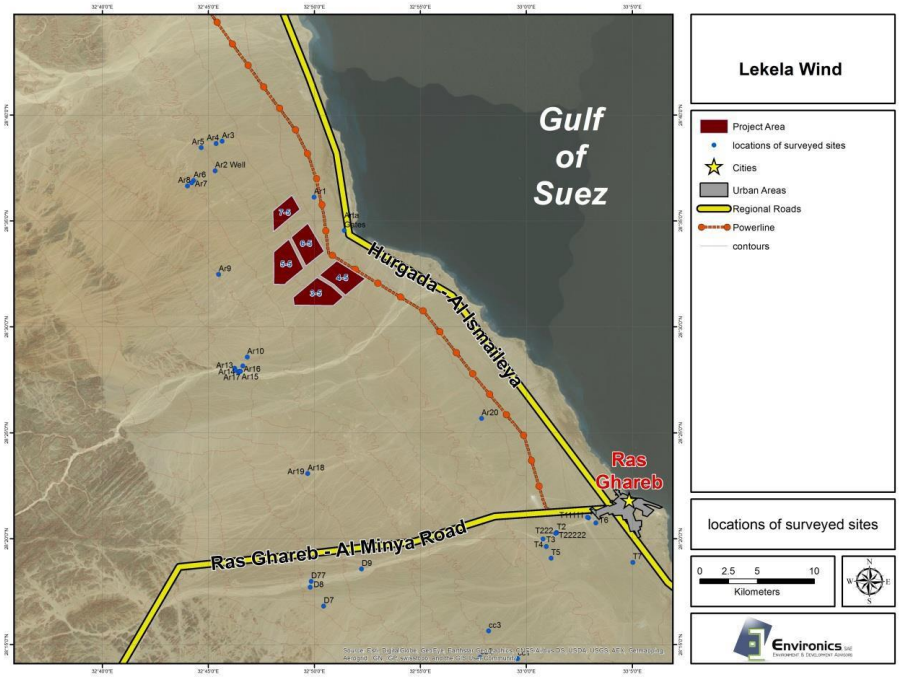

Figure (4-11): The sites surveyed during the August 2014 survey

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

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 Lahmeyer International and Ecoda (2017) for the whole wind farm area indicate that the vegetation cover in the project area is extremely sparse and restricted to single drainage channels. Vegetation within the project area generally has a low species composition, density and a very patchy distribution. The wadis tend to support the most vegetation due to generally higher soil moisture levels. Permanent plants can only be found in:

- Smaller wadis crossing the project area from west to east in its northern part;
- Wadi Um Tinassib in the middle of the project area; and
- Wadi Hawashiya in the southern part of the project area.

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 occurs within the project area. All species found within the project area are common and widespread in the Eastern Desert and, thus, not believed to be endangered or threatened.

d. Fauna

The faunal description is based on literature review and previous surveys of the project wider area (Environics, 2014c; NREA 2013; Lahmeyer International and Ecoda, 2017), as well as a project specific survey carried out during the period 9-10 November 2015. The surveys included the main wadis dissecting the coastal plain and the littoral area. Attention was given to Wadi Hawashiya that runs in the immediate south of the Lekela Egypt site.

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 (4-12~~Figure (4-12~~).

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Figure (4-12): 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 (4-13~~Figure (4-13~~).

Figure (4-13): 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 (4-14~~Figure (4-14~~**. Other common resident birds include the House Sparrow (*Passer domesticus*), Barn Swallow (*Hirundo rustica*) and Rock Dove (*Columba livia*).

Figure (4-14): 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.

It is important to mention that during the November 2015 survey, Environics' team came across a hut used by poachers for illegal falcon trapping. The local driver informed the team that falcon poachers originating from the Delta are frequently encountered in the area.

Mammals

Few mammals have been documented in the study 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* 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) 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 Lekela Specific Project Area

The specific project area includes the site and its immediate surroundings. Accordingly, the eastern part of Wadi Hawashiya located south of the Lekela Egypt project site is included among the project area.

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 Lekela Egypt site is totally devoid of vegetation **Figure (4-16~~Figure (4-16~~Error! Reference source not found.**).

Figure (4-16): Lekela Egypt project site showing the total absence 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 (4-17~~Figure (4-17~~**). The wadi soil differs from that of the project site located in the coastal plain. It has a looser texture mainly composed of sand, with few gravel and pebbles.

Figure (4-17): 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 Lekela Egypt 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.

4.2.3 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[6] (Figure (4-18~~Figure (1-18~~) 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[7], personal communication).

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.

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

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 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*).

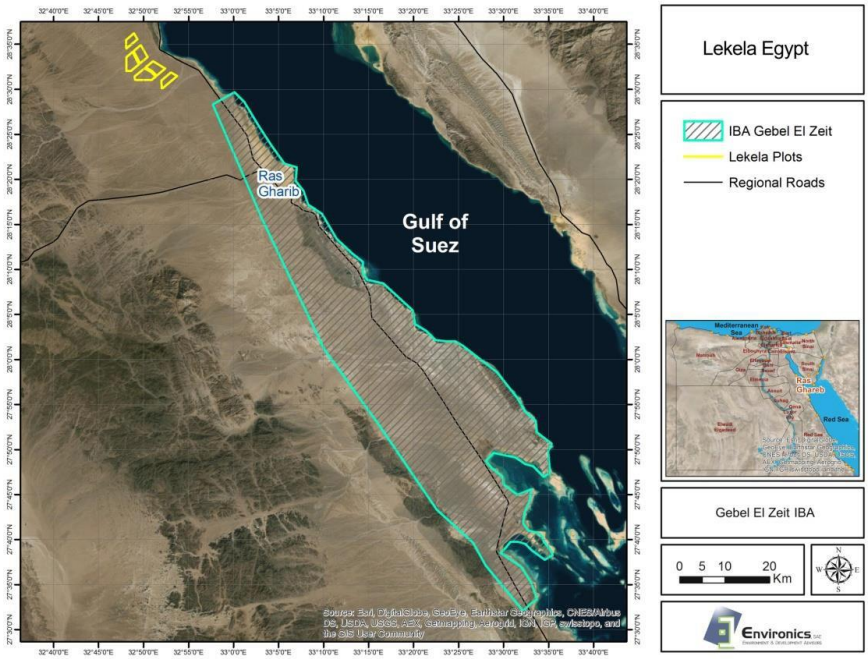
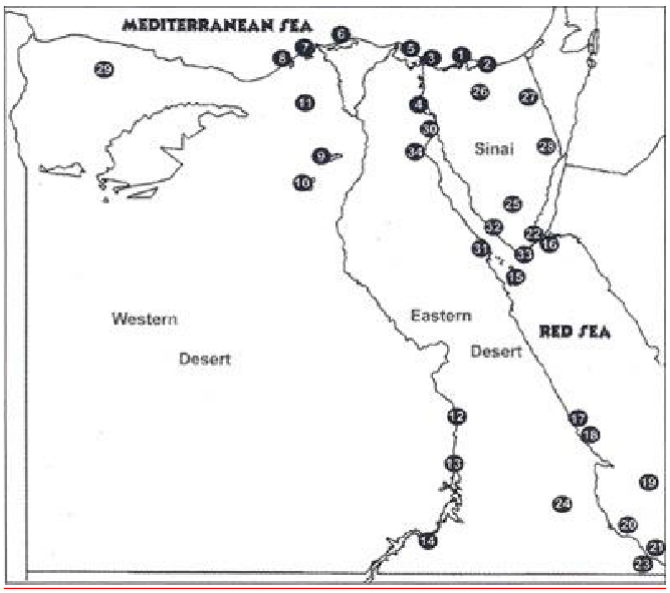


Figure (4-18): Location of Gebel El Zeit IBA (source: BirdLife International)

Other IBAs in the Region

In addition to the IBA located within the vicinity of Lekela project, there are other IBAs in the Gulf of Suez region as shown in **Figure (1-19~~Figure (1-18~~)**. **Table (1-2~~Table (1-2~~)** shows the distance of the IBAs from the Lekela project.



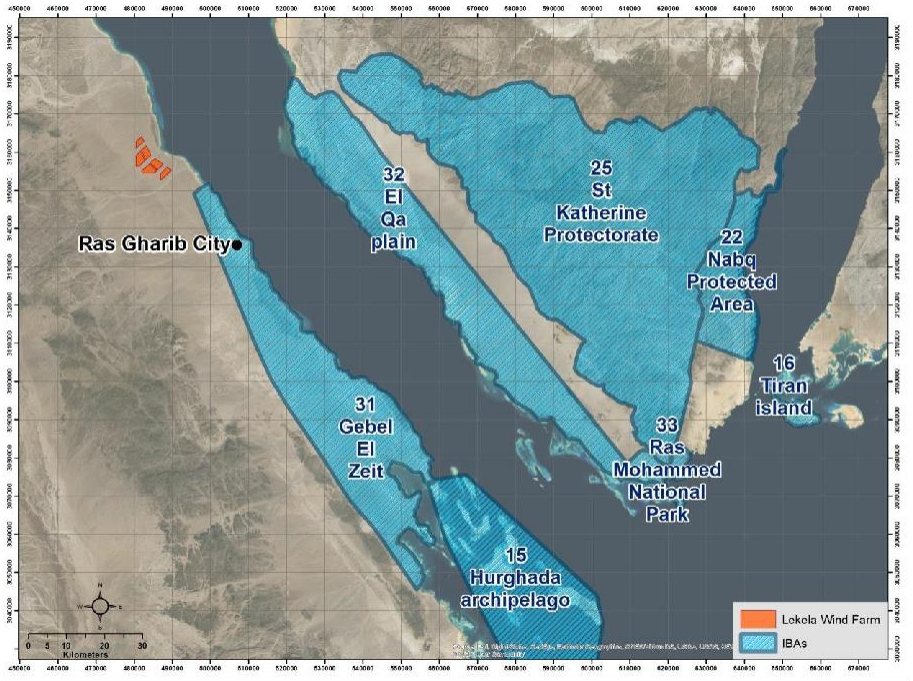


Figure (1-1918): IBA areas within the Project Region

Table (1-2): Distance from IBAs from Lekela Project

IBA Name	IBA Code	Distance from Lekela Wind Farm (KM)
Gebel El Zeit	31	9
El Qa plain	32	33
St Katherine Protectorate	25	50
Hurghada archipelago	15	106
Nabq Protected Area	22	140
Ras Mohammed National Park	33	142
Tiran island	16	168

Based on the above table it is clear these IBA are not located within the area of influence of Lekela project and thus are not expected to be impacted by the project activities.

4.2.4 Monitoring results of Wider Project area

Given the ornithological importance of the area, a detailed seasonal ornithological survey has been prepared by Lahmeyer International and Ecoda (2017) for RCREEE 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 Lekela 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 by wind farms 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 on migrating birds was based on standardized observations using fixed observation sites. With regard to the extent of the project area, 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. A summary of the seasonal ornithological survey is presented in the following.

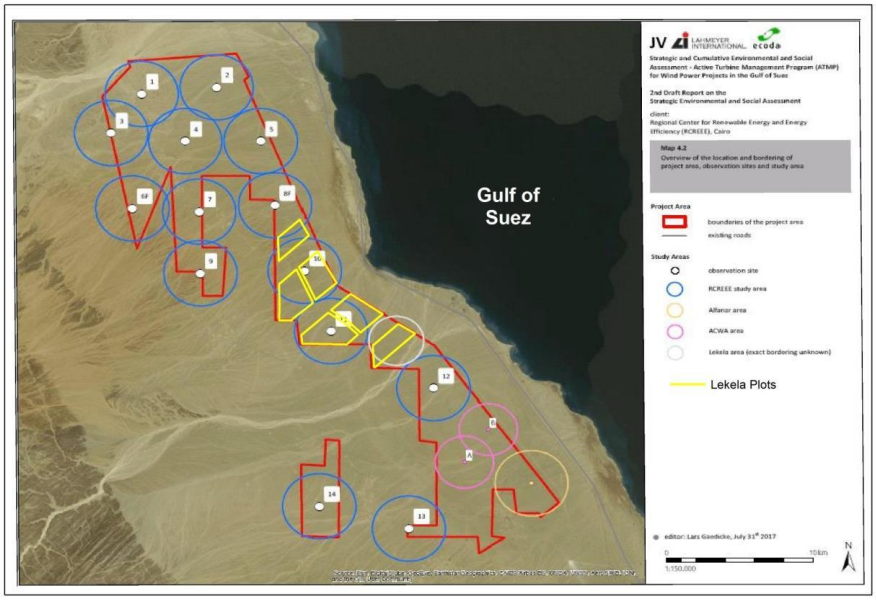


Figure (4-20): Locations of the observation sites within the project area (modified from Lahmeyer International and Ecoda, 2017) showing the location of the Lekela site

Autumn findings

During 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 (roughly representing the rotor swept area of wind turbines). 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).

4.2.5 Monitoring results of Lekela specific project area

In addition to the monitoring activities carried out for the wider area, Lekela has performed detailed seasonal ornithological surveys targeting the specific project site have been carried out in:

- 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 is 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 (4-21~~Figure (4-21~~) below. 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.

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Figure (4-21): The study site showing observation points and 2 km observation radius around each

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 different seasons studies each site has been 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 species 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.

The autumn 2017 a total number of observation 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 of 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, like the observations in springs of 2017 and 2016 the same seven species that contributed about 95% of the total soaring birds recorded, except for 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. Of these 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 4-3a below present the results of monitoring for the different seasons.

Table (4-3a): 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 (4-3b): 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 Sparrow hawk	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 Lekela Egypt 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 the presence of wildlife were recorded in the eastern part of Wadi Hawashiya, very close to the southern borders of the site Figures below.

Figure (4-22): Stools found in eastern part of Wadi Hawashiya

Figure (4-23): 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 its immediate surroundings (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.

There *are no habitats of special concern found within the Lekela Egypt project site, which is in the wide coastal plain and close to the northern* edge *of Wadi Hawashiya. The western part of the wadi is of concern, as it supports most of biodiversity of the area, and thus can be considered a sensitive habitat. Although this 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.*

The project site is located along a migration pathway of global importance for many protected species of birds. Accordingly, a detailed ornithological survey for migratory birds has been carried out. The results indicate that the autumn season is of minor importance when compared to the spring season.

Table (44-4): 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[8]				
Mourning Wheatear	*Oenanthe lugens*	Probable	Wadi Hawashiya	Common resident of the Eastern Desert. Recorded in habitats like those of the project area.

[8] Do not include avifauna recorded during the ornithological survey. Details of the seasonal ornithological survey are presented as separate reports.

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 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 Wolf	*Canis anthus*	Unlikely	Project site and/or Wadi Hawashiya	Few records in the Eastern Desert.

4.3 Socio-Economic Environment

The Lekela Egypt site is located in a desert area where no communities or human settlements are found. The closest city is Ras Ghareb located about 28 km from the project site. Ras Shoqeir is located about 28 km to the South of Ras Ghareb City (about 62 km from the project site), while Wadi Dara Village is located about 50 km to the south of Ras Ghareb City (72 km south of the project site). El Zaafarana is located about 100 km to the north of Ras Ghareb City (65 km north of the project site) Figure (4-24~~Figure (4-24~~).

The following sections present a brief account 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).

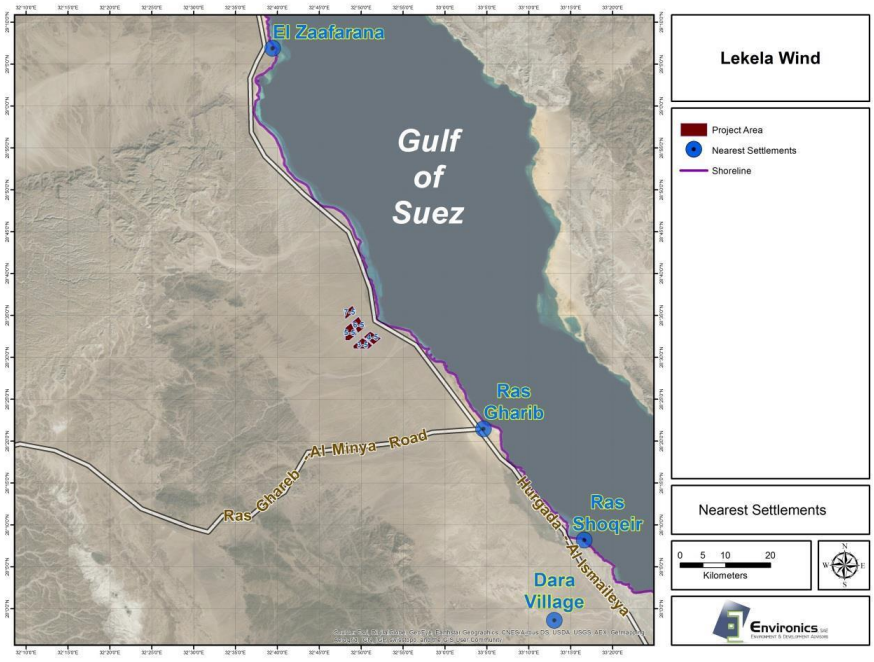

Figure (4-24): Location of the nearest settlements to the project site

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 storey 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 taxis operate in the area. The main airport in the area is 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. Currently a new double road, Gabal El Galala Road, Sokhna-Zaafarana is being constructed and is expected to be completed and operational by October 2016. The road is three lanes in each direction in addition to two interconnections to the old (existing) coastal highway.

Trucks of various sizes will be required for transportation of all project components distributed throughout its construction period, about 18 months, with varying intensities. In addition, workers will be transported to the site during construction.

4.3.2 Socio-demographic Characteristics

a. Demographics

The number of population of Ras Ghareb is about 59, 785[9] residents. 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 expatriates (coming temporarily from other locations for job opportunities in the area.), (CAPMAS, 2006).

Local Communities[10]

The Bedouins in the Red Sea Governorate are made up of four main tribes, Tababna, Sheihk Fadi, Hamadine and Khushman.

Table (1-1): Local Bedouin Tribes

Tribe	Geographic Area	Population
Tababna	80 kms west of Ras Gharib and located in the project's concession areas.	Ten people in Ras Gharib.
Sheihk Fadl	Ras Gharib to Zaafarana.	70 people including 20 people in Zaafarana.
Hamadine	Ras Gharib to Gabal Zeit.	Unknown.
Khushman	South towards Hurghada.	Unknown.

The tribal social organization is mainly based on tribal affiliation and extended family systems. The tribe is led by "sheikhs", who are the tribe's representatives in any external dealings In Ras Gharib, the Tababna are led by Sheikh Hamid while Sheikh Frieg and Sheikh Mohamed Ayed handle the interface with the police and army on behalf of the Tababna. This tribe and the Khushman tribe are nomadic and move freely to graze cattle. The Bedouin do not hunt deer or birds and do not fish.

The Bedouin in the have territorial rights and any operator is seek their approval for land access and negotiate the price of this land and any associated jobs.

The Bedouin are mostly employed in security roles, they can also provide additional provision of services related to workers, such as catering, transport etc., which may provide more temporary jobs to this community.

[9] Kina's Report 2018

[10] Ibid1

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 or higher (CAPMAS, 2006).

4.3.3 Social Services

4.3.3.1. 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 kindergartens with total capacity of 789 children and average class density of 30 children (Education Department, 2013/2014).

4.3.3.2. 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). There are 49 nurses at the hospital who nurse 39 patients currently (February 2018).

The exact number of doctors is not known because they rotate between hospitals in the Red Sea Governorate. They also operate their own private clinics in Ras Gharib in the afternoon although there are no private hospitals in the town.

There is high demand for clinical care and a flat rate fee of LE 1 (USD0.05) is charged per patient. Follow up examinations or treatment is charged separately. The central hospital General Manager complained about the lack of surgeons and an increased demand on resources during the tourist season due to an increased number of Road Traffic Accidents (RTA) stating that there can be up to five RTAs each day[11].

4.3.3.3. 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).

Social Security and Safety: There is a total of three social units and 38 NGOs (31charity 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). Following are examples of the NGOs and areas of

activities:

Name	Activities	Additional Information
Nahdet Baladna	Income generating activities are provided in three areas. **Health** • Drugs Rehabilitation Programme including prevention, treatment of addicts from an addiction eradication fund, and an outreach scheme. • Delivery of medicine to retired people via a monthly subscription scheme. • Medical discounts for vulnerable groups and those in need. • Early identification of viruses. • *Note: Speech therapy was previously provided but the speech therapist left due to poor wages.* **Education** • Teaching of the Koran, English, IT skills and literacy skills. **Social Services** • A Special Needs School supports those who are physically-challenged and those with sight and hearing impairments. • Building of a play park. • Running a sports day for 300 children.	The Board of Directors include university educated youth, accountants, and engineers. Funding is provided by private donations, National NGOs and Kuwait Energy.
Ras Gharib Association for the Protection of the Environment	Awareness Raising • Climate change campaign. • HSSE training provided by Hattm Abul Enein in ISO9000 / ISO14001 / ISO18001 / ISO22000 / OSSA Working at Height / Food and Medicine Safety. Recently 179 people were trained including 39 from the City Council. Beach Protection • Monitor the beach and report issues to the Police. • Conduct beach clean-up campaigns funded by petroleum companies. • Engage with petroleum companies on sea pollution. Waste Collection • Petroleum companies contract with them to transport waste water to Alexandria. They do not handle solid waste. • During the floods, they deployed water removal vehicles to pump the water away using three from the town and renting four others. They collaborated with the army and petroleum companies in the clean up. Beautification • Planted 700 trees and painted pavements and kerbstones following the 2016 floods.	The NGO has three permanent members of staff and a network of volunteers. *Note: The NGO was not invited to RCREEE's EIA public consultation meeting and has tried to get access to the meeting minutes which they know should be publicly available but this is proving difficult.*
Muslim Youth Association	Focused on care for vulnerable groups. **Female Club** • 625 members. • Delivers programmes in illiteracy eradication, reading and teaching of the Koran, awareness raising about social issues	Oldest NGO established in 1970. Principal lead has been with the Association for 17 years. Have partnered with the ILO

[12] Ibid8

	such as drug addiction and supports vocational skills training such as dress-making. - Supports women in marketing and selling their goods for a percentage of the sales price. - Arranges field trips. **Vulnerable Groups** - Must be registered with Ministry of Social Solidarity. - Includes divorcees, physically-challenged, those whose husbands are unable to work and those who receive free or financial support for medical care. - Families must have a total monthly household income of below LE1,200 to qualify to receive support. - Beneficiaries are monitored to evaluate improvements in their standard of living. - Access to a dentist, pediatrician, optician, GP, gynecologist and surgeons is provided. - Food distribution is managed monthly and on behalf of community donations and national NGOs such as Orman and the Food Bank. - Support brides in preparation for their weddings. **Education** - Runs a nursery for children from three months of age. - 200 children are registered. **Income Generation** - Koshery sales. - Rent out shop units that surround the NGO building.	on management training, building businesses and providing Microsoft training.

4.3.4 Economic Activities

a. Employment and Unemployment

According to CAPMAS (2006), about 51% of total population (15+) in Ras Ghareb District is inside the labor force, representing an unemployment rate of 12%. Table (4-6) below presents the employment status for Ras Ghareb. Unemployment estimates of 2014 in Ras Ghareb was 9.8%[13].

Table (4-6): Population (15+) distribution by mode of employment, CAPMAS 2006

Sex	Self employed	Wage earner	Unpaid laborer	Un-employed	Total labor force	Student	Housewife	Retired	Other[14]
M	7.4	82.5	0.2	9.9	73.8	48.2	0.0	12.8	39.0
F	1.1	76.7	0.7	21.4	23.2	18.4	76.5	0.8	4.2
T	6.1	81.3	0.3	12.4	50.3	26.8	54.9	4.2	14.1

[13] Desk review Decent Jobs for Egypt Young People – Red Sea governorate, International Labour Organization (ILO), 2014

[14] This category includes: elderly not able to work, incapable to work, and not willing to work.

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 -[15].

Aside from a single hotel, there is no tourism industry in Ras Gharib, nor are there any professional services such as legal or accountancy firms. Specific information on women employment in Ras Ghareb is not available. However, total Red Sea Governorate data[16] indicate that, women's participation in the labor force was 6.9% in 2007. Of the total number of Egyptian women in the national workforce, over 50% were in paid employment. In Ras Ghareb, women tend to be employed as nursery and primary school teachers, pharmacists, shopkeepers and in the civil service[17].

In addition, there are various restaurants/cafes along the Suez/Hurghada road at the height of Ras Ghareb, some of which are closer to the project site than others. They provide services to all types of travelers using this road. it is expected that the additional incremental economic impacts on these small businesses as result of Lekela project is expected to be positive, temporary and limited to the construction period.

One company, Petro Red Sea, is a services supplier to the petroleum industry managing transportation services, housing, civil works and labour supply. They report to have access to 3,000 unskilled and semi-skilled workers from Ras Gharib and their clients include Petro Dara, West Bakr, Petro Amir, Suco, GUPCO and GPC[18].This service company could be potential source for provision of local workers.

However, during Lekela stakeholder consultation meeting in April 2018, General. Yasser Shaaban Head of Ras Ghareb City, as well as other attendees, stressed on the importance of coordination with Ras Ghareb municipality regarding employment provision and that the city is willing support in providing the required logistics for community training on renewable energy. Eng. Eman Rahsad - EETC indicated during the meeting that the electricity agreement with Lekela states that a minimum of 25% of the labour should be local. Lekela confirmed that its approach with regard to employment is to priortise local labour as appropriate and requires its contractors to adhere to this approach.

[15] the data presents the main registered activities at CAPMAS, remaining percentage is categorized as "not identified"
[16] Ibid 9
[17] Kina report 2018
[18] Ibid 11

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 lives in an apartment. Less than 1% (0.7%) of households in Ras Ghareb City lives 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).

Possible Accommodation Options

There are various options for extended duration rental housing in Ras Ghareb ranging from whole apartment buildings to rental of individual apartments, some of which are out of town close to the Suez/Hurghada regional road. A typical two-bedroom house costs between LE700-800 (USD40 – 45) per month. Buildings are limited to a maximum level of four storeys due to constraints imposed by the military. In addition, there is a single hotel in Ras Gharib, the El Amir Palace Hotel.

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As unskilled and semi-skilled construction workers can be sourced from Ras Ghareb, these accommodations will be mainly used by technicians and engineers (although being an oil town, some of those could also be available locally). This may minimize the need for an on-site camp.

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c. Utilities

According to CAPMAS census of housing conditions in 2006, most 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

[19] Lekela BOO ESIA report – Chapter 8, April 2018

water inside their dwelling and are connected to the public water network. There is good water and electricity supplies in Ras Gharib. There are two large and visible water pipes located on the perimeter of the town. El-Sheikh Fadl, 245 kms to the west of Ras Gharib, also has access to good utility services.

The site is located within oil concession and a large part of the wider area has been allocated for wind power development.

There are no human settlements or livelihood activities within the proximity of the Lekela Egypt project site. The closest settlement is Ras Ghareb City located about 28 km south of the project site. Currently, the main road to the site experiences very low traffic load. In some sections the road is not very well serviced, however, after establishing the new Gabal Galala road the site accessibility will be highly improved.

d. Electromagnetic Interferences

Wind turbines could potentially cause electromagnetic interference with aviation radar and telecommunication systems (e.g. microwave, television, and radio). The nature of the potential impacts depends primarily on the location of the wind turbine relative to the transmitter and receiver.

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.

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[20], about 15 km inland from the Gulf of Suez, west of Ras Gharib, indicate that there are no archaeological, historical and cultural heritage sites existing inside or adjacent to the study area[21].

[20] Adjacent to the project site

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

On the other hand, Castel[22] 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[23] mentioned that there are great chances that archaeological sites are 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).

The most proximate areas of archaeological significance are found to be about 50 km or more from the wind farm site. 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.

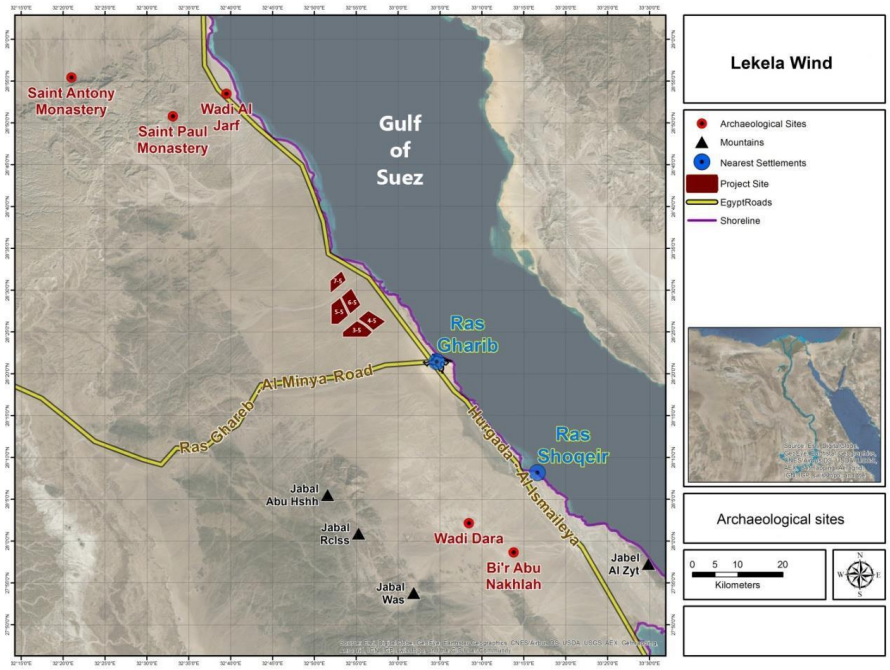

Figure (4-25): Sites of archaeological significance near the project site

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

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

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 plant 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, namely wind energy. The project will also contribute to meeting part of continuously increasing energy needs in Egypt. In addition, the project contributes 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, the land proposed for the development would still be used for other renewable energy projects as the site is owned by NREA and has been designated for renewable energy projects.

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 wind power technology

Vertical Axis Wind Turbines (VAWT) [1] For VAWTs, the rotational axis of the turbine stands vertical or perpendicular to the ground. They also can perform well in tumultuous wind conditions. Vertical axis turbines are powered by wind coming from all 360 degrees, and even some turbines are powered when the wind blows from top to bottom.

Figure (5-1): Vertical Axis Wind Turbine (VAWT)[1]

However, due to their limited capacities, VAWTs are primarily used in small wind projects and residential applications rather than utility scale projects where horizontal axis turbines dominate.[1]

In addition, the selected turbine configuration is based on 70-73 WTGs rated at 3.6MW. Another alternative based on 120 WTGs rated at 2.1 MW was discarded as it would have resulted in a higher risk to migratory birds. Reducing the number of WTGs, and thus increasing the distances separating them also reduces the barrier effect.

[1] http://www.windpowerengineering.com/construction/vertical-axis-wind-turbines-vs-horizontal-axis-wind-turbines/

5.3 Alternative location

The Government of Egypt (GoE) has designated the area for NREA for construction of wind farm project. The GoE has selected the location based on the survey of wind potential in Egypt (available in a Wind Atlas). In addition, based on the Feasibility Study for a Large Wind Farms at Gulf of El Zayt prepared by NREA[2], the area has been categorized into three ornithological zones according to the weight of the expected environmental impact on migratory birds as shown in figure 5-2 below. The Lekela BOO is located zone 3.

Zone 1: Wind Park Construction is banned

This part belongs to the main migration corridor heading towards Sinai. Local differences of migration density within this zone are considered to be accidental, as migration routes vary according to wind conditions.

Zone 2: Construction Subject to Further Ornithological Monitoring and Verification

This zone is situated in the border area of the Zone 1 and might even belong to it. In this respect, further ornithological monitoring and verification would be required for wind power development in this area.

Zone 3: Construction critical

In this zone the terrain opens out and offers the birds more room to manoeuvre. Wind farm installation in that area would require technical avoidance/mitigation measures. Careful post construction monitoring programme would also be required.

[2] DECON-Fitchner (2007b). Feasibility Study for a Large Wind Farm at Gulf of Zayt. Ornithological Investigations Summary of Findings Report. Prepared for KfW-Entwicklungsban / NREA.

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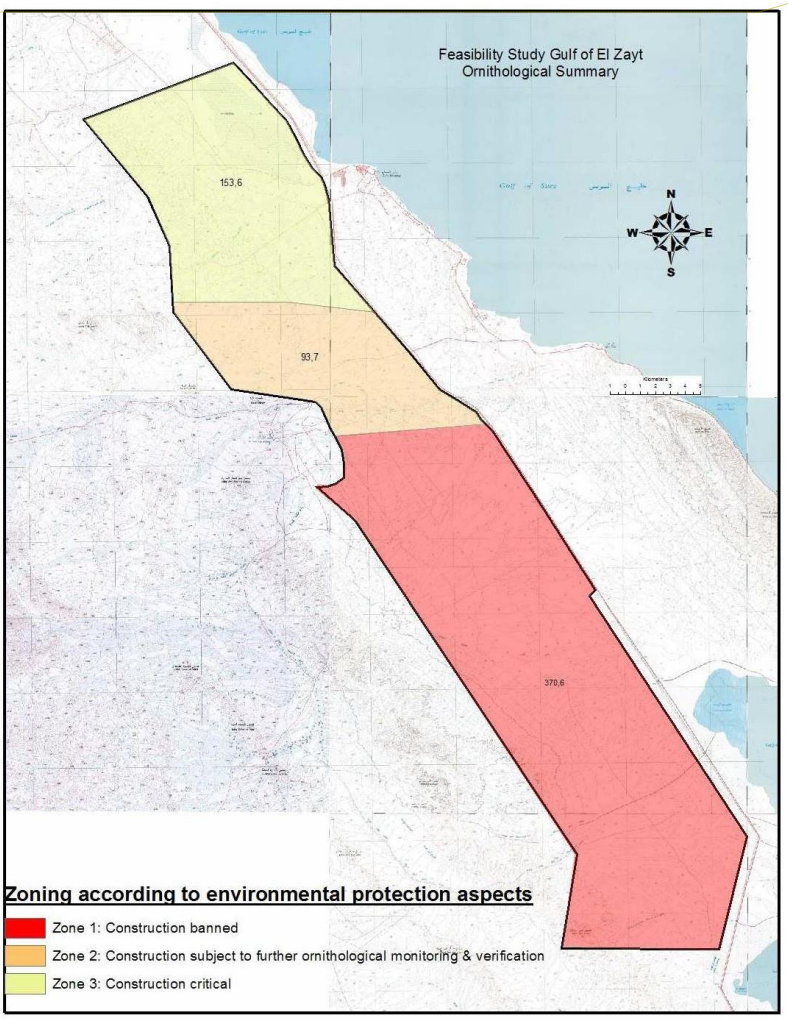

Figure 5-2 Ornithological zones

5.35.4 Alternative water sources

Water consumption is not considered significant for wind power projects. Mostly, water will be required during the construction phase mainly for concreting related to the turbine foundations and the substation. During the construction phase, water demand for sanitary purposes will be minimal.
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, located about 67 km south of the Lekela Egypt site. The collected information from 20 groundwater wells in Wadi Dara reveals that the well

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depth varies between less than 10 meters and reaches up to 300 meters. 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 maybe significant.

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[3]. 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 can arrive in ready-mix form. Otherwise, water for making concrete will be from trucks transporting water from the Hurghada – Ras Gharib Nile water pipeline.

Significant water consumption will only be during the construction phase. Thus, given the flexibility and adaptability of water trucking, it is most convenient during operation.

[3] 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 has been designed so 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, 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 wind farms have been expanding on the road from Zaafarana to Hurghada

during the last decade. 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 near 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 fence 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 - Electrical and instrumentation - 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
	• 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 takes 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. The highly skilled wind energy technicians can provide training to local employees, increasing their skills level so that they will be employable on other wind power projects.

  It is estimated that during the construction phase of the project would provide about 300 direct job opportunities to the local community. During operation, permanent employees on site are expected to be approximately 12.

  It is envisaged that local medium sized businesses will be able to supply most auxiliary components such as ladders, ducts and platforms as well as nuts and bolts. Work opportunities would also be created for consultancies including wind measurements, O&M services etc…[3]

[3] Prospects of renewable Energy Sector in Egypt, Focus of Photovoltaics and Wind Energy, Environics 2010

In addition, there are various restaurants/cafes along the Suez/Hurghada road at the height of Ras Ghareb, some of which are closer to the project site than others. They provide services to all types of travellers using this road. Additional incremental economic impacts on these small businesses as resulting from the Lekela project is expected to be positive, temporary and limited to the construction period.

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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[4].

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

- **National energy security**
  During operation, this project will directly provide electricity from wind energy at utility scale. Accordingly, it would contribute to the minimization of dependence on the depleting fossil fuels and minimize the associated environmental adverse impacts. During the construction period, a diesel generator will be used.

  The project will also allow Egypt to benefit from one of its main renewable energy resources, namely wind energy. The project will also contribute to meeting part of the continuously increasing electricity needs in Egypt.

- **Reduction of GHG Emissions**
  There are no global warming emissions associated with generating electricity from wind energy. Thus, this project contributes to minimizing greenhouse gases emissions, particularly CO_2, that would have been generated if the same amount of energy had been generated from conventional fossil fuel fired power plants. There are no direct emissions pertaining to onshore wind production. Emissions are rather released due to infrastructure and supply chain operations. Lifecycle emissions from onshore wind power production has a median value of 11 tCO2eq/GWh compared to 820 and 490 tCO_2e/GWh for coal, combined cycle natural gas respectively[5]. In Egypt, the total average CO_2 emission from all thermal power plants is about 540 tCO_2e/GWh[6].

  Given that the expected annual production of the Lekela Egypt plant is 1,119 GWh, approximately 581,927 tCO_2e is abated annually.

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

[5] Schlömer S., T. Bruckner, L. Fulton, E. Hertwich, A. McKinnon, D. Perczyk, J. Roy, R. Schaeffer, R. Sims, P. Smith, and R. Wiser, 2014: Annex III: Technology-specific cost and performance parameters. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change

[6] Annual Report for Performance Indicators for Electricity Generation Companies, Egyptian Electric Utility and Consumer Protection Regulatory Agency, 2012-2013

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 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.

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 will occur for relatively short duration and 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 34 km to the east of the proposed site. Thus, this impact is considered minor.

As previously mentioned, there are oil concessions areas assigned for petroleum explorations within the project area. The activities currently being implemented include seismic investigations, exploration as well as development and production activities. No air emission sources are currently present in the direct vicinity of the Lekela project, as drilling and production are at least 5 km north and west of the Lekela site. No flaring takes place in these locations, given the very low gas to oil ratio in the reservoir[7]

Mitigation Measures

To prevent dust emission from vehicles Lekela Egypt and their 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.

Lekela Egypt and their 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

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[7] Personal communication with West Bakr HSE manager

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 efficient for minimizing the potential impacts. Therefore, the residual impacts of construction on the air quality are negligible.

Operation phase
During operation, vehicles transporting water and wastes to and from the site will generate insignificant air emissions, considering the individual project. However, considering transportation relating to all projects, air emissions might be significant.

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 project area is located 2 km east the Ras Ghareb – Zaafarana Highway, and the coastal town of Ras Ghareb is about 28 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[8]

[8] 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

Mitigation Measures

Lekela Egypt and their contractors must put in place these control measures:

- Machines and construction equipment must comply with the latest technical developments
- Periodical maintenance of machines and equipment with internal combustion engine according to the manufacturer's instructions.
- In the choice of the location of the machines and stationary equipment must be privileged maximum distance respect to who is sensitive to noise.
- Noise and vibration measured outside the site must be in compliance with local Act minimizing the impact on sensitive targets.
- Organize the site in order to obtain hearing protectors from logistic infrastructure.

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 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

Individually, noise generated from the Lekela Egypt plant will not be of great significance. However according to the Environmental and Social Impact Assessment for the adjacent area of 300 km² and the Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP), ~~based on literature review~~[9], potential cumulative noise from wind farm plants ranges from 35 to 65 db. In this respect, the ambient noise level of 45 dB (A) (noise limit for residential areas in cities) is expected to be achieved at distance of about 300 m away from the WTGs and the lowest defined ambient noise level of 35 dB (A) is achieved at about 1 km distance to the wind farm while the first. Given the significant distance of receptors at Ras Ghareb, the contribution of the wind farm to the ambient noise level is minimal. Furthermore, it is worth mentioning that the IFC Wind Farm Guidelines, (2007 and the revised draft guidelines of 2015) state that if no sensitive receptors are within 2,000 meters of any of the turbines in a wind energy facility, a noise impact assessment is generally not required. In this context, cumulative noise modeling including other neighboring wind farms might not need to be considered. Figure (6-1) shows the Noise propagation at wind farm boundary area.

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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

[9] Estimated noise values arising from wind farms available from NREA study (2013) and Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez 2nd Draft Report (D-5-2) on the Strategic Environmental and Social Assessment-August 2017

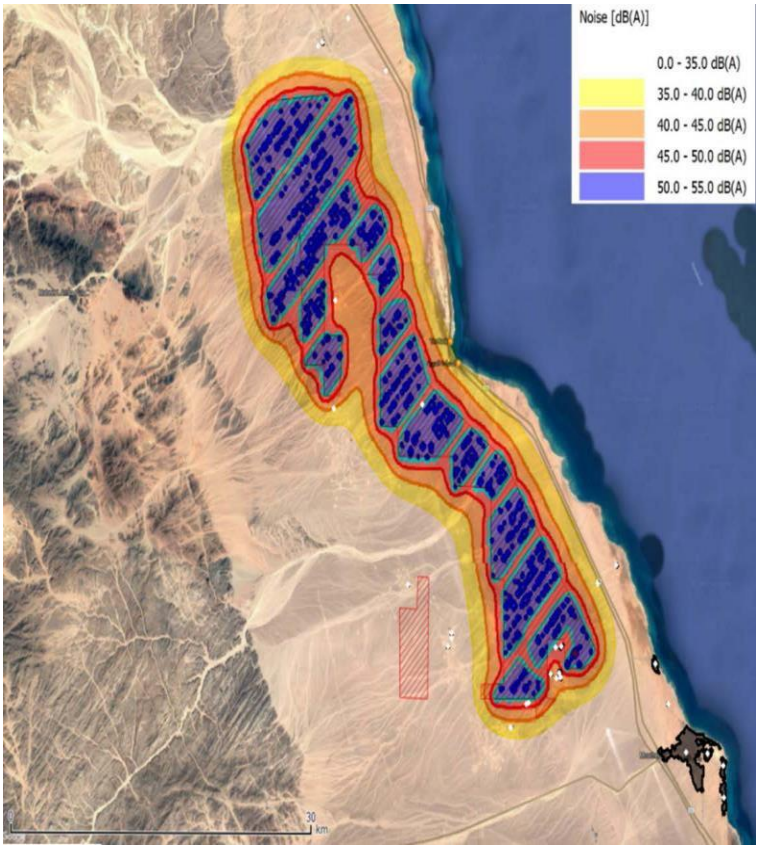

Figure (6-1): Noise propagation at wind farm boundary area.

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Accordingly, the potential noise impact is considered insignificant.

Noise during operation may also arise from the transformers which are contained in an enclosure with restricted access. Noise levels, expected from transformers is shown in the table below and are less than the allowable limits of law 4/1994 as described in Chapter 2.

Table (6-3): Expected noise levels from transformers in workplace

	Noise level (dB(A)
Transformer	60 dB(A) *

**For a 2 MW transformer with 24 kV voltage rating*

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 transformers area and providing the 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 contraction 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 contractors.
  The contractor will be forced to good workmanship and housekeeping during construction by contractual stipulations and by assignment of supervising engineers in order to assure adequate disposal of solid waste and waste water, to avoid or to collect spillages of used oils, greases, diesel, etc. Diesel fuel used on site is to be stored and contained 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.

A septic tank 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:

- Eliminating causes for slippery floor
- 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 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 should include response to spill scenarios.

The supply or change of oil, lubricant or hydrocarbon to vehicles will be done in gas stations. These activities should not be carried out on site and strict control must 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 seepage trucks.

Residual impacts

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

- **Water**

  Water consumption during construction for the different construction activities is estimated as follows:
  - WTG foundation pouring: 50 m³ per WTG foundation
  - WTG foundation curing: 10 m³
  - WTG components cleaning before erection: 2 m³ per wind turbine

  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 - 12 person)

  Water use will be optimized and this quantity will not have significant impact on water resources. Lekela Egypt will also carry out preventive maintenance of machinery using water (tank truck) to avoid water leaks or losses and monitor the proper functioning of toilets, avoiding leaks, overflows, etc.

  It is worth mentioning that the impact of this project on water resources consumption is of little consequence, however, on the scale of the entire complex the impact will be more pronounced. Thus, it will be addressed jointly by all developers.

  The daily water production data of 2012 in Ras Ghareb is about 10,180m3/d[10] (Red Sea Water Company website). Remarkably, the same source states that the production capacity in 2016 is 7750 m3/d. This is translated to 130 to 170 l/cap, both lower that the standard of 250 l/cap. Current desalination project underway to be executed by the armed forces.

  The demand for water was estimated as 50 m³ per foundation. Assuming an average of one foundation per day, the figure could be used as the daily demand[11] for construction during approximately 10 weeks. The quantity would be approximately the same whether a concrete batch plant will be installed or concrete will be outsourced, as both options will source water from the same source. On the other hand, several workers of about 300 (assuming very conservatively that all workers are from outside Ras Ghareb area) requiring a maximum of 75 m3/d at peak construction period. This quantity is most likely to be much lower, as the peak construction period is when most of the unskilled and semi-skilled workers are fielded, and these are readily available in Ras Ghareb.

  Even with conservative assumptions, the incremental demand on water is minimal (representing +/- 1.5% of water produced (more likely 1%). However, as the quantity of water produced is not up to acceptable per

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[10] http://www.redsea.gov.eg/moderyat/DispActivities.aspx?ModID=%D8%B4%D8%B1%D9%83%D8%A9%20%D9%85%D9%8A%D8%A7%D9%87%20%D8%A7%D9%84%D8%B4%D8%B1%D8%A8%20%D9%88%D8%A7%D9%84%D8%B5%D8%B1%D9%81%20%D8%A7%D9%84%D8%B5%D8%AD%D9%8A%20%D8%A8%D8%A7%D9%84%D8%A8%D8%AD%D8%B1%20%D8%A7%D9%84%D8%A3%D8%AD%D9%85%D8%B1&ID=219

[11] Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez – RCREEE 2018

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capita construction standards, it might pose pressure on the available water resources in the area.

Lekela is considering as part of its Community Investment Strategy in Ras Ghareb to support the municipality in leak detection and control to contribute to sustainable water use and management in Ras Ghareb by reducing water losses from the system.

6.2.3 Impact on the Biological Environment

The project sites‟ are located in the wide coastal plain and 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 western part of Wadi Hawashiya, located close to the southern boundaries of the sites, 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, modification and fragmentation by using areas for fundaments of turbines and of auxiliaries, permanent access roads, erection platforms, trails for the power line, storing positions for heavy machines and other technical installations.

  During construction of the wind farms, which includes mobilization and demobilization, removal and partial destruction of the top soil surface and some deeper soil layers will occur. However, the land use for wind farm construction is very limited (usually less than 3% of the overall area) leaving most of the area free from any interventions (NREA, 2013). Consequently, the affected area will cover only a small fraction of the project sites.

  Moreover, the sites are 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 for wind farm construction is very limited, no critical habitats are found within the area 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.

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 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 turbines and related infrastructure 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 efficient for minimizing the potential impacts. Therefore, the residual impacts of construction on flora are negligible.

Fauna (excluding avifauna)
The project installations and infrastructure 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 have been recorded from Wadi Hawashiya.

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 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 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 together 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 considered as a significant impact.

Construction of wind farms might also lead to the modification or a loss of habitat for local birds by using areas for foundation of turbines, 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 of wind farms 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 of a wind farm by removing garbage from the wind farm area.

Mitigation Measures

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

To mitigate impacts on migrating, roosting and local birds caused by large wind farms in the project, the following measures have been proposed in the Strategic Impact Assessment study for the whole wind farms in the area prepared by Lahmeyer International and Ecoda (2017):

- Avoid turbines with lattice towers. Lattice towers offer suitable perching sites and, thus, might attract migrating, roosting and local birds which in turn might increase the risk of collision.
- Paint turbine blades to increase blade visibility and, thus, to decrease collision risk for migrating roosting and local birds. This can be achieved by using blades with black and white aviation markings.
- Restrict turbine height to a reasonable maximum total tip height, as collision risk for migrating birds is believed to increase with turbine height. A maximum total tip height of 120 m is recommended. However, this should not be regarded as a strict limitation. According to the technical characteristics of modern turbines exceeding a height of 120 m might be acceptable to a certain degree.
- Avoid lighting of wind turbines, as birds might be attracted to wind farm areas by lights leading to an increased collision risk. If lighting of turbines is absolutely required (e.g. to meet aviation requirements of the civil and military aviation authority), the minimum number of intermittent flashing white lights of lowest effective intensity shall be used.

- Build the grid within a wind farm area and the grid between different wind farm areas by underground MT cables. If the use of overhead lines cannot be avoided (e.g. 220 kV OHL), such overhead lines should be designed according to available guidelines (e.g. BirdLife International).

- **Operation Phase**

Habitats
No impacts are expected to occur on habitats during operation of wind turbines, 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 impact of wind farm operation on habitats is negligible.

Flora
Operation of wind turbines is not known to affect plants or plant growth. Also, slight changes in wind speed (turbulences) or in microclimate at ground level will have no effects on plants.

Human activities and off-road driving might affect local flora during maintenance of wind farms.

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 and shading resulting from operating turbines is limited in space and time. Hence operating wind farms are not expected to impact wildlife which is already very limited. As turbines will not be erected near the larger wadi beds noise occurring from turbines will not affect animals inhabiting or using these wadis.

There might be a risk of disturbance of species by site personnel, by off-road driving, by waste from used spare parts or by hazards from non-sufficiently isolated cables during maintenance activities.

- Maintenance activities will be restricted to the area close to the wind turbines.
- 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, 2017).

  According to this study, birds in active flight are not affected by the construction of wind turbines. Noise and dust emission at distinct construction sites might bring migrating birds to alter their flight path, but this cannot be regarded as a significant adverse impact. Hence, construction of wind farms does not cause significant impacts on migrating birds – neither on target species nor on species of minor relevance.

  Collision Risk

  Considering utilization of wind energy within the project area, the major potential hazards to migrating birds are mortality due to collision as well as barrier effects. Migrating birds of target species might be significantly affected by an operating wind farm. Thus, the potential effects of operational wind farms in the project area have been analyzed and discussed for migrating birds of target species.

  Migrating birds of species of minor relevance (mainly passerines) do not concentrate in certain areas and, in addition, collisions at onshore wind farms do not seem to be a major concern (according to current knowledge). Hence, no significant adverse impacts are expected when operating wind farms in the project area. Consequently, there is no need for a detailed assessment of effects on migrating birds of species of minor relevance.

  The study also indicates that it is very difficult to assess collision risk as well as avoidance behavior, which might lead to increased energy expenditure caused by a proposed wind power plant. Thus, the impact assessment should be regarded as a qualitative prediction of possible impacts under consideration of the precautionary principle (worst-case-approach), which needs to be specified by further field investigations in bird-wind turbine interactions (e.g. postconstruction monitoring) at the western Red Sea coast.

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 which is considered as to be threatened or near threatened. Consequently, collision risk at a wind farm in the project area is not assumed to pose a major threat for large soaring birds in autumn. Single collisions at a wind farm within the project area might occur even during autumn migration, but the expected collision rate is unlikely to result in significant effects on the birds' population. Therefore, collisions at wind turbines within the project area 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 when operating an individual wind farm in the project area. This 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 Sparrow hawk 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. Hence, appropriate mitigation measures and a thorough post construction-monitoring are required for each individual wind farm to reduce the risk of collision to an acceptable level.

- **Assessment for the Lekela specific project area**

Collision Risk

In addition to the Strategic Impact Assessment for the whole wind farms in the area carried out by Lahmeyer International and Ecoda (2017), Environics has carried out site specific autumn and spring Collision Risk Assessment for the Lekela project.

The risk analysis conducted here, followed the Scottish Natural Heritage (SNH) Collision Risk Model (CRM) (SNH 2000, 2010), which is the standard CRM approach adopted by previous studies conducted in the Gebel El Zeit area. The SNH CRM is one of several approaches that seek to provide an estimate of the potential number of bird collisions likely to occur at a given wind farm. The main source of risk that is considered is that of collision with the moving rotors of wind turbines. Potential collision with power lines has been also taken into consideration. It is important to point out that, it is

important that CRM results cannot be treated as the sole tool for risk evaluation, but rather as a gauging tool that may provide a basic sense of magnitude of risk that can be anticipated. The empirical results of post-construction monitoring and carcass surveys would provide more factual data that can be used in risk management after wind energy infrastructure is in place.

The different available CRM models tend to be linear in nature and treat migratory birds, more or less, as projectiles that fly through the airspace in straight lines. This does not normally take into account the behavioral and avoidance responses of birds when confronted with the turbines in the field. Studies indicate that behavioral avoidance is quite high in birds, reducing collision potential by up to 99%. To help account for the behavioral avoidance responses by birds, the current CRM model applies two avoidance rates ranging between a conservative 95% avoidance rate and a more realistic avoidance rate of 98%.

For Autumn season

For the autumn study periods, the outcome of the CRM predicts that the total potential casualty level from active wind turbines (without any mitigation measures) within the study area (a total of 84 turbines) during the study period (15 August – 5 November 2017), would be about between 54 and 22 birds (at the avoidance rates of 95% and 98), with a casualty rate of 0.64 – 0.25 birds / turbine / season (according to turbine specs and number provided by developer). The predicted casualty levels for autumn 2017 (at the 95% avoidance rate) are somewhat lower than that predicted for autumn 2015 (0.64 birds / turbine / season; versus 0.83 birds / turbine / season in 2015).

For Spring season

For the spring study periods, the outcome of the CRM predicts that the total potential casualty level from active wind turbines (without any mitigation measures) within the study area (a total of 84 turbines) during the study period (20 February – 15 May 2017), would be about between 114 and 46 birds (at the avoidance rates of 95% and 98%, see Table 27 below), with a casualty rate of 1.4 – 0.5 birds / turbine / season (according to turbine specs and number provided by developer).

The predicted casualty levels for spring 2017 (at the 95% avoidance rate) are somewhat higher than that predicted for spring 2016 (1.4 birds / turbine / season). In fact, the predicted casualty levels for site 1 (same study site as in spring 2016) are remarkably similar though slightly higher than in 2016 (24 birds / season in 2017, as compared with 22 birds / season in spring 2016).

Similar to the results of the 2016 spring study, three species are predicted to make up 96% of the total estimated casualties: White Stork (57 birds, representing more than 50% of the total estimated

casualties); Steppe Buzzard (37 birds, representing about 29% of total); Black Kite (7 birds, representing 6% of total); and Steppe Eagle (about 4 birds, representing some 4% of total). White Pelican did not appear this year as a significant risk due to low numbers at RSH. The predictions do reflect seasonal / annual changes and shifts in bird numbers and species compositions at the local level, but still reflect a considerable consistency

Barrier effects

Based on the SESA 2017 results concerning barrier effects, it is indiacted that an individual wind farm is unlikely to cause significant barrier effects during spring migration. Barrier effects caused by a single wind farm in the project area are regarded as a moderate impact on migratory soaring birds in spring. No further management and mitigation is required except from applying best practice procedures and general mitigation measures.

Lekela project specific studies indicated that impacts of barrier effects and disturbance (in isolation from other adjoining projects) will be very minimal due to the limited scale of the project area, the lack of local vital habitats for feeding or resting of soaring birds and to some extent the distance of the study site from critical bottle necks and the main migration flyway for soaring birds.

Mitigation Measures

The following mitigation measures are included in the Strategic Impact Assessment carried out by Lahmeyer International and Ecoda (2017).

Collision Risk

Wider project area

As per the SESA report 2017, it is very difficult for several reasons to assess collision risk as well as avoidance behavior, which might lead to increased energy expenditure caused by a proposed wind power plant. Thus, the impact assessment should be regarded as a qualitative prediction of possible impacts under consideration of the precautionary principle (worst-case-approach), which needs to be specified by further field investigations in bird-wind turbine interactions (e.g. postconstruction monitoring) at the western Red Sea coast.

If turbines do not operate during periods of high migratory activity and / or periods when larger flocks occur, collision risk for migrating birds can be minimized. Thus, operation of a large wind farm in the project area seems to be acceptable if an effective shutdown program will be developed and established and if technical avoidance and further mitigation measures to the best standard practice will be maintained. With regard to the development of such a shutdown program, the Strategic Impact Assessment Study indicate two possible alternate approaches:

Fixed shutdown (FS) program

A FS-program presents a worst case-scenario assuming a high collision risk for migrating birds during the overall migration period and during the entire daytime. The FS-program might be applied in the case that no alternate mitigation measures are effective. Under consideration of the precautionary principle the FS-program follows a conservative approach in which collision risk at operating turbines will be minimized, while in return the loss of energy yield of a wind farm will be highest.

If applying a FS-program all turbines of a wind farm shall be stopped during the critical migration period in spring (i.e. March 1st to May 18th) during daytime (i.e. 1.5 hour after sunrise to 1.5 hour before sunset).

Shutdown on-demand (SOD) program

A SOD-program is regarded as a useful and effective mitigation measure for reducing collision risk for migratory soaring birds at wind turbines. It is of particular value in areas where the impact on migrating birds cannot be reliably predicted, where the impact could vary greatly depending on specific weather and migration patterns and where high concentrations of birds during passage or vulnerable species occur.

When applying a SOD-program selected turbines are stopped in times of high collision risks, i.e. during periods of high migratory activity or when a large flock approach a wind farm. Special consideration has to be given to the criteria used in triggering a shutdown. Criteria should aim at minimizing the risks to birds while at the same time reducing losses of energy yield. In the absence of detailed information as to the factors influencing high-risk situations these criteria must remain dynamic and flexible in order to be able to react to new information and knowledge.

In two other wind farms, four criteria for triggering the shutdown of turbines have been applied:

1. Threatened species
   Turbines shall be shut down whenever a bird or birds of a threatened species are detected migrating through the wind farm area or heading towards it at risky flight altitudes (i.e. within the rotor-swept area).

2. Flocks with 10 or more large soaring birds (target species)
   Turbines shall be shut down whenever flocks with 10 or more large soaring birds are detected migrating through the wind farm area or heading towards it at risky flight altitudes.

3. Imminent high risk of collision
   A single turbine or turbines shall be shut down whenever there is an imminent high risk of collision of a large soaring bird (e.g. a bird approaching a turbine at a close distance).

4. Sand storms
   Turbines shall be shut down during sand storms whenever criteria 1 and 2 have been verified in the two hours that preceded the sand storm.

   The results indicate that the SOD-program has been an efficient and successful measure leading to a low number of collision victims (even though a small number of birds collided) and to short periods of shut downs. Thus, the criteria for shutting down times used at the two wind farms shall act as a starting point for a large wind farm in the project area. The criteria shall then be fine-tuned through an adaptive management approach resulting from on-going monitoring and benefiting from the experience obtained during the first seasons

   Lekela Site specific area
   Potential risk management measures can be adopted and modified according to improved understanding of risks at the site. Proposed mitigation measure involves mainly a shutdown on demand system that responds to specific triggers that are agreed upon between the developer, the EEAA and NREA. In all cases this should be combined with monitoring to assess effectiveness of shutdown and refine its parameters, making it more efficient, including the length of the risk window, which is likely to become much smaller with more available data.

The following mitigation measures are proposed for Lekela project, based on the seasonal (autumn and spring) ornithological studies carried out by Environics:

- Maintaining a pre-construction bird migration monitoring effort at least during the peak migration periods in both spring and autumn.
- 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. However, stopping the wild dumping of Ras Gharib's domestic waste inside the wind power plant area and cleaning it from waste should be done collectively with other developers.
- Reduction of risks from power lines through installing markers or underground power cables.
- Post-construction monitoring, particularly during the initial stages of operation to verify bird response predictions, and intervene if critical issues arise. This knowledge will be used to refine any shutdown or other risk management measures that need to be taken, and hence reduce long-term costs. The post construction monitoring effort must include a systematic carcass survey to assess actual mortality during operation.
- Year 0 – 1 of operation: Shut down on demand (SOD) will be performed from the start of operation. Pre-construction data indicate clearly that soaring bird migration takes place in peaks, and is not distributed evenly across the migration season. Moreover, over the specific day witnessing a peak, the crossing of birds over the site is

not uniform over the day but is rather concentrated in specific hours of the day. With seasonal and daily peaks, the option of a fixed shut down scheme is excluded as it substantially increases the losses in power generated without a reduction in risk of bird collision. The actual configuration of the SOD scheme will be designed and carried out in full coordination and cooperation with other concerned parties. These, in all cases, include neighboring wind farms for which a collective ATMP is currently being developed by RCREEE and, in case of radar detection, these will also include the armed forces.

- Year 1 – 4 of operation: Implement a shut down on demand system. Shutdown on demand will require a constant monitoring effort and a clear set of triggers.
- Year 4 and beyond: It is anticipated that a shutdown on demand system and long-term monitoring (composed of systematic carcass surveys and a sampling effort) will be required for the life-time of the project.

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

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

- Abide by all national occupational health and safety regulations, Law 12/2003
- 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 implement manufacturers‟ health and safety instructions concerning the erection, commissioning and maintenance of the wind turbines.
- Strictly supervise health and safety measures undertaken by the local civil works companies, which may be employed via the main contractor, especially with regard to wearing safety clothes, to equipment safety and a safe working environment.
- 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 wind power projects 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 (workers influx)**

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 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.

For individual projects, the number of non-local workers will be considerably low and thus their impact on the community is negligible.

Potential pressures on the available resources and utilities may result due to workers influx to the area.

Mitigation Measures:

Based on Lekela's employment policy priority will be given to workers from Ras Ghareb depending on qualifications and skills for the available jobs. A number of workers are likely to be sourced from outside Ras Ghareb although the extent of these will be known following further consultation with EPC contractor and their sub-consultants. Preliminary investigations indicate that there are various options for extended durations in the rental sector ranging from whole apartment buildings to individual apartments, some of which are close to the Suez/Hurghada main road and so convenient for travel to site. Use of this accommodation will avoid the need for a labour camp on site although the preferred option is still under investigation by EPC contractor.

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- **Site security**
  For security measures, Lekela 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 to 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 for single project. The cumulative impact will be addressed collectively with al developers.

- **Light reflection and shadowing**[13]
  The blade coating of modern turbines does usually absorb direct sun light and, thus, reflection does not cause any environmental impact. The critical impact of shadowing (flickering) as per acceptable standards is 30 hours per year and 30 minutes per day. This can be achieved only at places near to wind turbines, where the observed transition time of the sun through the rotor diameter can achieve such durations. As there are no residences or housing near to the turbines, it is obvious that there is no impact from flickering beyond acceptable level.

6.2.5 Impact of the project on traffic

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 there are not any critical impacts on the traffic on public roads during the wind farm construction. And 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.

If water will be transported by trucks during operation, the impact on traffic is expected to be minimal.

Trucks of various sizes will be required for transportation of all project components distributed throughout its construction period, about 18 months, with varying intensities. In addition, workers will be transported to the site during construction.

[13] Based on project SESA 2017

Should there be a site based temporary accommodation camp, there are advantages and disadvantages. If a high proportion of the labour required needs to come from outside the local community, onsite facilities ensure that social impacts (poor behavior, disease, and strain on existing social services) are more manageable. In addition, workforce transportation will be minimized. However, this means that there will not be the same level of community benefits leveraged if there was utilization of existing local housing / hotel stock. Another consideration would be the length of the construction period and whether temporary accommodation is appropriate / desirable.

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Accordingly, the incremental contribution of the individual project is expected to be minimal. It is important to note that as Lekela Egypt plant is part of the whole wind farm area which sub-projects could have similar execution schedules, due to timeframes set. Accordingly, the impact on traffic is to be considered collectively for all projects.

The results of the strategic impact assessment currently under preparation by NREA/RCREEE will address this issue and will be incorporated when finalized and approved

6.2.6 Impact of electro-magnetic field

According to the Environmental and Social Impact Assessment for the adjacent Area of 300 km², wind turbines could potentially cause electromagnetic interference with aviation radar and telecommunication systems (e.g. microwave, television, and radio).

According to the IFC Environmental, Health, and Safety Guidelines for wind energy, the nature of the potential impacts depends primarily on the location of the wind turbine relative to the transmitter and receiver, characteristics of the rotor blades, signal frequency receiver, characteristics, and radio wave propagation characteristics in the local atmosphere.

According to the Environmental and Social Impact Assessment for the adjacent Area of 300 km², as the wind power plant area has already been cleared by the Ministry of Defense before being assigned for wind power development by presidential decree and as no feedback has been received from the Ministry of Defense during early stakeholder participation, it can be assumed that no interference with a coming wind farm is expected. Likewise, it is not expected that the radar will have negative impacts on the electronic system of wind turbines (e.g. top controller). One mobile phone telecommunication mast and a radio link mast are placed at the Ras Gharib- El Shaikh Fadel asphalt road. No indication on necessary clearing distances was obtained during early stakeholder participation from the Ministry of Telecommunication and from the mobile phone companies.
Thus, keeping sufficient corridors and safety distances, no significant impact on electromagnetic systems such as radar, telecommunication and television broadcast is expected.

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;
  - Make 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 preliminary literature data indicate that project site is located in an area of low flood intensity streams. The low flood intensity does not contradict the medium to high flood risk level. In fact, the high flood risk is an indication of the 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 is large and hence the

runoff depth and velocity will be small. Moreover, the low flood intensity does not mean that the study area is safe against flash floods. 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.

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 or along its peripheries Figure (6-2);
- Detailed hydrologic and hydraulic analysis are required to determine the accurate water depth and water velocity at each point inside the project area;
- Based on the hydraulic analysis results, design the appropriate flood protection structures (if required)

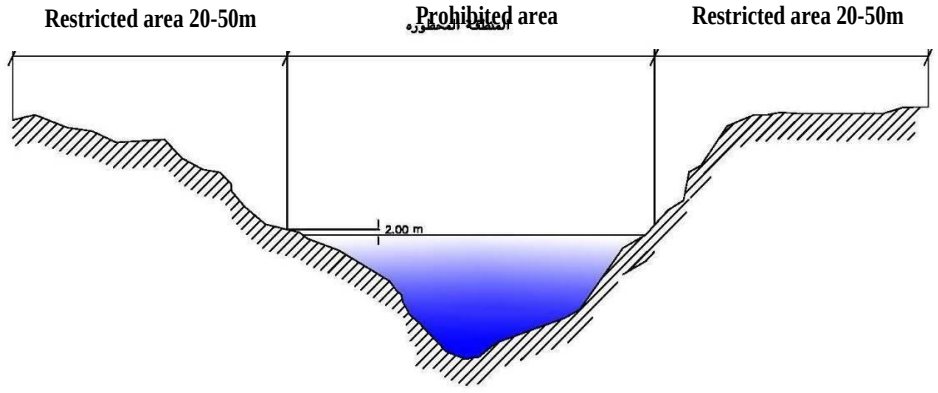

Figure (6-2): Flood zones (safe, Prohibited and unsafe zones) inside the wadi

6.3 Cumulative Impacts

The IFC "Good Practice Handbook Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets", indicates that although the environmental and social impact assessment (ESIA) process is essential to assessing and managing the environmental and social impacts of individual projects, it may be insufficient for identifying and managing incremental impacts on areas or resources used or directly affected by a given development from other existing, planned, or reasonably defined

developments at the time the risks and impacts are identified. In other words, the impact of a specific activity may not be significant, but may develop significance when added to the existing and potential impacts resulting from similar or diverse activities or undertakings in the vicinity.

The IFC Performance Standard 1 limits cumulative impacts to be addressed to those impacts generally recognized as important based on scientific concerns and/or concerns from Affected Communities. Examples of cumulative impacts include: incremental contribution of gaseous emissions to an air shed; reduction of water flows in a watershed due to multiple withdrawals; increases in sediment loads to a watershed; interference with migratory routes or wildlife movement; or more traffic congestion and accidents due to increases in vehicular traffic on community roadways.

In this context, it is important to point out that generally, wind projects do not pose significant environmental adverse impacts during operation activities, except of the potential impacts on the avifauna, and the potential impacts during construction are localized and short term and considered insignificant for the individual project. And the significance of impacts from all projects depend completely on the execution schedules; i.e. whether construction starts simultaneously or not. Assuming activities on all plots start simultaneously, the main potential ***cumulative impacts*** to be considered by the collective assessment for all projects within the wind farm complex would include:

- **Impact on water resources**
  Cumulative effects rising from parallel construction activities for all sites in the wind farm complex will be significantly higher than for one single project. Water will primarily be used during construction for sanitary purposes and concreting (in case concrete mixing is onsite and ready-mix concrete is not used) and abstracting water from the existing water pipeline (Hurghada – Ras Gharib) may impact the local communities served by the water pipeline.

  During operation, few employees will be present on site and thus water consumption and waste water generation will be inconsequential.

- **Traffic and logistics management**
  Transport of workers to and from the projects sites may be significant in the high peak periods when all developers have ongoing works at site. Transport of workers to and from their accommodation may also cause significant noise/nuisance in the local communities in high peak periods when all developers have ongoing works at site.

  During construction, if water will be transported via tankers from the water pipeline, water vehicles may add more traffic loads on the public roads. However, there are no human settlements or livelihood activities within the proximity of the wind farms area. 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 load. In some sections the road is not very well serviced. However, with full operationalization of the new Gabal Galala road the site accessibility is expected to be highly improved. The road is three lanes in each direction

in addition to two interconnections to the old (existing) coastal highway which would accommodate the potential traffic load from all wind farms. In this respect, the potential cumulative impact on traffic is not significant.

- **Workers accommodation**
  During construction, workers may be accommodated in nearby local communities or temporary construction camps. Additional land will be needed for other associated facilities (equipment storage, vehicle parking, tanks etc.)

  In case workers are accommodated in the vicinity of residents, especially during construction phase, their presence could cause potential strain on resources, noise, and waste generation.

  Irrespective of the type of accommodation, Lekela will require the living conditions to be in line with IFC standards "Workers" accommodation: processes and standards. A guidance notes by IFC and the EBRD, 2009".

- **Noise**
  The only sensitive noise receptors in the region are the residents of the town of Ras Gharib, 25 km to the site. In addition, no potential noise receptors exist along the new Galala road.

  The ESIA for the neighboring 300 km^2, noise propagation from the wind farm during operation was checked by a standard wind farm modeling programme. The ambient noise level of 45 dB (A) (the noise limit for residential areas in cities) is already achieved at distances of about 300 m away from the turbines. Even the lowest defined ambient noise level of 35 dB (A) is achieved at about 1 km distance to the wind farm. The closest receptor to the project is the Ras Ghareb – Zaafarana Highway at about 2 km to the east of the project.

- **Avifaunal impacts**
  Developing numerous wind farms in the vicinity of birds could have a significant, cumulative impact on birds. Those impacts on bird populations could include habitat destruction due to physical footprint of wind farms, disturbance and/or displacement by construction and maintenance activities and possibly by the operation of the facilities, and mortality caused by collision with the wind turbine blades, collision with the power line network associated with the wind farm, and electrocution on the required power line and substation infrastructure.[14] Mitigation measures to avoid and/or mitigate such impacts have been presented in section 6.2.3.

[14] Roggeveld Wind Farm, Western and Northern Cape. Environmental Resources Management. 2011. http://www.sahra.org.za/sahris/sites/default/files/additionaldocs/20111007_Roggeveld%20EIR%20Ch%2016.pdf

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 wind 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 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.

The 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 • 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). • Limit off-road driving within the project sites and prohibit driving in wadis, particularly Wadi Hawashiya, to avoid soil compaction.	Not significant/ negligible
• 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.	Not significant/ negligible

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
		• Avoid vegetation clearance when erecting the turbines and related infrastructure; • 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	
• Avifauna	minor	• Site area management and waste management • Adequate distance between wind turbines and turbines‟ characteristics	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 • Provision of suitable PPE, training and ongoing safety checks • Equipment periodic maintenance according to manufacturers' schedule	Not Significant
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
• 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			
• Machinery and equipment	Not significant	• Potential noise generating machines and equipment are designed to meet	Not significant

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
		regulations concerning noise. • 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.	
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 • Septic tank integrity checking • Good house-keeping measures; and, • Emergency response plan to include response to spill scenarios.	Not significant
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 • Shutdown system and post-construction monitoring • Executing the requirements of the ATMP program by RECREE	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	Not significant

Issue	Impact category (not significant, minor, moderate, major)	Mitigation Summary	Residual Impact
		• Installing fire detection and fighting system • Equipment periodic maintenance according to manufacturers' schedule	
4- Socio-economic			
• Employment	• Positive	• Work opportunities for local communities	Positive
• Workers influx and accommodation	• Minor for the single project	• Approximately 12 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, and Lekela Egypt's commitment to the protection of persons and the environment, the facility will have an HSE policy. Lekela Egypt, 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 wind power plant project is summarized as follows where the Client refers to Lekela Egypt:

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

- The Client will designate for the project a HSE team, who 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.

- Contractor 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 to Contractor and to 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 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 of the risks and hazards that have been identified;
4. A monitored 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 must 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 is 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 by comparing 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 change is occurred. 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 pre-task risk assessment must be completed prior to the start any job/task by those involved in the task. Risk assessment must be reviewed whenever an accident happens. The document shall be submitted to Lekela Egypt, for review and approval.

A set of measures are to be taken by Lekela Egypt 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, Lekela has a “stop work” policy where each Lekela employee regardless of their position, seniority or role, has the right and duty to intervene and stop any activities which they believe is putting health and safety seriously at risk.

7.2.2 Human Resources Policy

Lekela Egypt's Human Resources (HR) policies and procedures are based on Lekela's Code of Ethics and Human Rights Policy and are to be developed in line with international and local best practice.

Lekela's Code of Ethics expresses the ethical commitments and responsibilities in the performance of the business activities by the employees of Lekela's companies (including direct and indirect subsidiaries). It defines Lekela's commitments in managing its employees and the fundamental employee's rights and responsibilities.

Under the HR policy, Lekela is to provide employees 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, and maternity and other reasons;
- Entitlement to benefits;
- The employees" right to form and join workers" organizations of their choosing 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, Lekela 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, Lekela will establish policies and procedures for managing and monitoring the performance of third party performance.

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

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

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 plant. 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
- Transportation and vehicle movement
- Training and Awareness
- Community Safety
- Community Development
- Information Disclosure and Stakeholder Engagement
- Project Decommissioning Plans

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

- Security of the plant
- 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 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

Main source is domestic activities from workers as municipal solid waste will be generated from the warehouse and offices.

The contractor shall set a procedure that must be followed during handling, storage, transportation and disposal of waste generated as a result of typical construction activities, 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.
- Contractor shall prefer 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.
- Waste shall be removed on a regular basis in order not to store more than 100 m^3 of not hazardous waste and no more than 20 m^3 of hazardous waste and if not exceeding this quantity whenever the designated storage area is full.
- 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, 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. Supervisor shall promptly notify it to the Lekela Egypt's referent person.

7.3.4 Preventative and Corrective Maintenance

The main objective of the plant 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 by Lekela Egypt, based on their experience in the field.

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 in turbines, electric system, weather stations, monitoring system and security system to detect existing and potential defects. It is particularly important to inspect all plant equipment exposed to the weather.

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 plant 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 plant, 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. Lekela Egypt requires a preliminary assessment of the most common animals present on site. In case of presence, Lekela Egypt could require:

- Procedure to follow in case of snake's bit or animal's attack (reference person to call)
- Training on all the workers regarding the animals' procedure.
- Appointments of valid, trained persons in charge for the snake's bites and safely handle/capture reptiles.
- Training to a group of employees of the staff to be able to catch and relocate snakes.
- Use of appropriate PPE´s.

In case of presence of wild dangerous animals, the contractor is required to take all the reasonable measure to avoid the risk, such as:

- Training on all the workers regarding the risk and the measures implemented.

- Agreement with a trained animal wrangler, to assist the contractor in the management of the wild animal's presence.
- Use of appropriate PPE´s.
- Provide a full-time surveillance patrol (especially before the erection of the fence).

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
- Installment of fixed and semi-fixed dry chemical fire extinguishing equipment

7.3.8 Emergency management plan

The emergency plan must be prepared by the Main Contractor or by an external service of Lekela Egypt, depending on the local law and by the type of contract. The emergency plan shall be ready before the start of the construction activity, submitted to Lekela Egypt 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 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 Lekela 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. 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:

- An overview of the identified HSE hazards on the project site, specifically regarding the interferences
- 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 (WTG Climb and Rescue-wind farm projects)
- Management of Chemicals and Hazardous substances (i.e. asbestos, explosives).
- 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, Lekela Egypt will assess the risks and impacts upon workers, local society and communities in and surrounding the project area of influence resulting from the use of arrangements provided by security personnel, whether privately outsourced or publicly provided.

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, Lekela Egypt 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. Lekela Egypt will investigate any allegations of unlawful or abusive acts of security personnel, take action (or urge appropriate parties to take action) to prevent recurrence, and report unlawful and abusive acts to public authorities.

7.3.13 Community Development

Community service is a key component for the ESIA. It is understandable that community needs could not all be addressed by one investor/project but should be addressed through collaborative efforts of the different developers.

A number of potential opportunities for community development exist and these can be categorized into:

- Training
- Health services
- Infrastructure

Training: This can include training courses for potential employment candidates as well as technical training for university students.

Health services: This can include providing ambulance services and improving local health units.

Infrastructure: this can include the construction of schools, roads and associated facilities.

It is of utmost importance that the means of community development is chosen and undertaken in full coordination with the governorate and local government entities.

7.3.14 Information Disclosure and Stakeholder Engagement

To ensure the correct level of engagement is being achieved by each stakeholder, the 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.

In this respect, the project will implement a Stakeholder Engagement Plan (SEP), during construction and operation of the project, which will include but might not be limited to the following components:

- Description of the regulatory and/or Lekela Egypt "s requirements for consultation and disclosure
- Description of resources and responsibilities for implementing stakeholder engagement activities
- Description of how stakeholder engagement activities will be incorporated into the promoter's environmental and social management system (ESMS).
- Regular liaison with neighbouring villages, district councils and the municipal authority to keep them advised of the project programme, progress and planned activities;
- Timely and appropriate disclosure of information about planned activities to neighbours and the local community prior to and during construction including, in particular, information about any disruptive activities such as transport of abnormal loads or noisy activities;

- Timely and appropriate disclosure of information regarding any significant changes in any activities, as relevant
- Timely and appropriate information about any non-routine activities during operation that could cause disruption, for example major maintenance or repair works;
- Clear information about Emergency Planning arrangements for the local community. Information will be disseminated to stakeholders in a culturally appropriate manner and will be freely accessible through forms of communication adequate to the relevant community.

This will be further clarified and investigated under the results of the strategic impact assessment currently being prepared by NREA/RCREEE

Grievance mechanism

In addition, the project would develop a Grievance Mechanism that allows the 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.

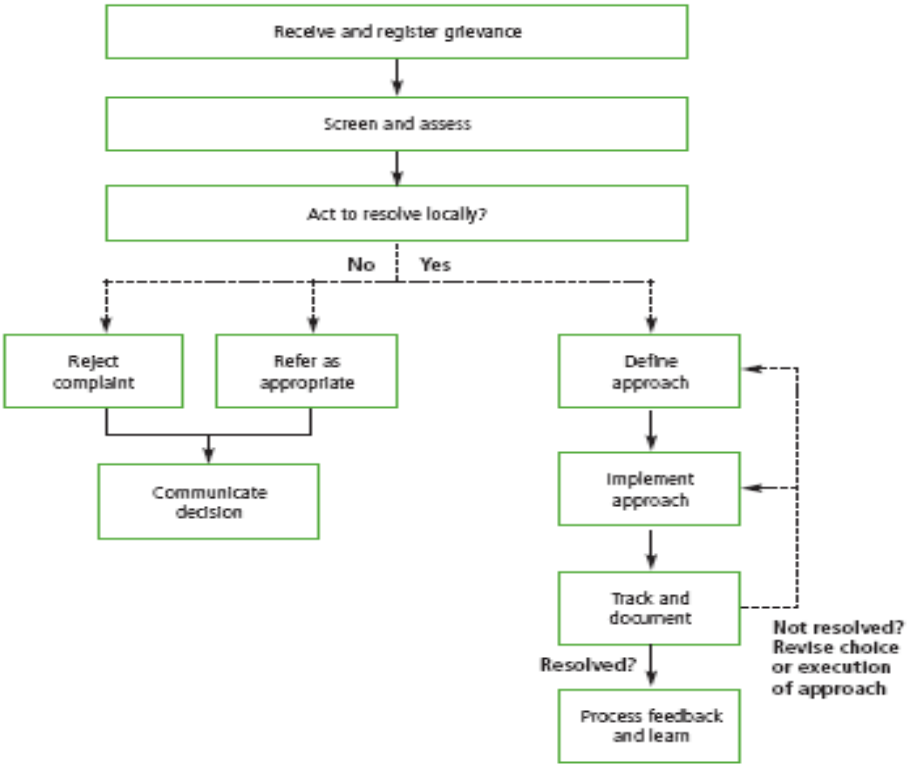

Figure (7-1): Example of Grievance Mechanism Structure

(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 no later than 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 supplier's 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.

7.3.15 Project Decommissioning Plans

Decommissioning is defined as the close 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 if 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
- Disassemble turbine

7.4 Monitoring Plan

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.

Besides, Lekela Egypt will establish private operational controls for preventive activities. 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

Lekela Egypt will draw up technical instructions of operational control, follow up and measurement for more specific activities or countries when it is necessary. Operational control guidelines established are subject to follow-up and inspection for appointed personnel by the Health and Safety Responsible.

The follow up and measurement is made monthly on site. Thus, Lekela Egypt knows about the failures of the Management System and the measures to be adopted in order to improve thereon.

Furthermore, it's verified that the measures proposed after the identification and evaluation of risks are implemented and effective.

The need for filing for non-compliances might arise after detecting aspects causing unsafe situations or aspects that don't comply with the regulations in terms of workplace Health and Safety.

7.4.1 Workplace Monitoring

HSE Audit

A Contractor shall implement a system to ensure the constant monitoring of the HSE level 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. Report of the audit must be kept on site and submitted to Lekela Egypt within 48 hours of the audit.
- Lekela Egypt ‟s HSE team will perform periodic audits to the site and to the documentation. Contractor is 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 meeting, with the presence of Lekela Egypt and subcontractor's representatives, in order to manage ongoing activities, and to avoid any interference. Lekela Egypt "s representative can require additional HSE meetings if necessary for the good management of the HSE aspects on site.
- 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 inside the plant result mainly from transformers and turbine movement. The measured noise levels will be compared to the levels set in Annex (7) of Law 4/1994. In case the noise exceeded the maximum limit of 90 dB, exposure periods will be proceeded as stipulated in Law 4/1994. Table (7.4) shows the noise monitoring locations and 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. A planned program or periodical tests, which may include clinical examinations, biological monitoring or others prescribed cases by an occupational medicine practitioner, could be required by Lekela Egypt.

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 required by Lekela Egypt, to be adjusted in compliance with the risk assessment:

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

Health and safety technician, qualified personnel
Lekela Egypt will designate for the project a HSE team, who will permanently stay on site to monitoring and auditing the execution of the contractors‟ Health and Safety Plans on behalf of Lekela Egypt, without thereby limiting the contractors‟ own responsibility for health and safety, or attracting any vicarious responsibility or liability for the contractors‟ acts or omissions.

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.

7.4.4 Approximate Monitoring Costs

An independent consultant would be hired for carrying out the monitoring activities. The following table (7-2) provides approximate monitoring costs for guidance purposes only. The costs only cover analysis and field measurements. However, they do not include specific sample collection costs.

Table (7-2): Approximate costs for Environmental Monitoring

Parameter	Description	Approximate annual cost (L.E)
Construction Phase		
Noise level	Measurement at 2 locations quarterly	1200
Air quality (SO_2, NO_2, CO, PM_{10})	Measurement at 2 locations quarterly	1800
Operation phase		
Workplace noise	Measurement at 2 locations twice a year	800

Table (7-3): 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	1800 L.E	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	1800 L.E and cost of maintenance	Throughout the construction phase period
	Provision of PPEs	-Providing necessary PPEs for workers	Construction contractor			
Soil	Housekeeping practices	-Develop and implement site management plan and a solid waste management plan	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
	Waste/wastewater management					
Occupational Health and Safety	Site Staff and Workplace Safety	-Implementing HSE procedures according to company, national	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						
		requirements and IFC standards				
Emergency Response	Site Staff and Workplace Safety	-Implement procedures for emergency control	Developer	Emergency response plan		Before project commissioning
Biological Environment	• access roads construction in wadis- • off-road and wadi driving • waste management • vegetation clearance • work activities at night and early morning • 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 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 Shutdown system and post-construction 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	

8. Public Consultation

8.1 Background

Lekela BOO project is located within NREA Wind Park in Ras Ghareb for which a comprehensive SESA has been prepared by RCREEE and presented for the public in October 2017. As the SESA has not yet been approved, EEAA required that Lekela organizes a separate public disclosure meeting to enable them to submit their comprehensive ESIA report to EEAA as an individual project.
In this context, Lekela organized a public disclosure and consultation meeting on Wednesday 4th of April 2018 in Ras Ghareb for identification of environmental and social concerns of different stakeholders regarding the proposed project. The following sections present process of the public consultation meeting and its results.

8.2 Stakeholder Identification

The identification of project stakeholders was based on an analysis of the institutional, legal and administrative framework of the project as well as the project location and activities.
In this context, stakeholders were identified taking into consideration:

- Nature of project
- Location
- Potential impact of the project

The target groups that were invited for the public meeting included those who are directly or indirectly involved in the project and those who have expertise and are interested in the topic (e.g. NGOs). Accordingly, stakeholders included:

- Public (potentially affected community)
- Regulatory agencies and competent authorities, and
- NGOs

Table (8.1) below presents description of the different stakeholders and their roles and/or potential interests in the project.

Table (8-1): Project Stakeholder

Stakeholder	Role/Concern
Agencies Connected to Regulation	
New and Renewable Energy Authority (NREA)	The Competent Administrative Authority (CAA) for Renewable Energy Projects
The Egyptian Electricity Transmission Company (EETC)	The counter governmental party for purchasing the generated electricity
Environmental Management Unit of the Red Sea Governorate (EMU)	Governorate within the project is being established and is concerned with issuing construction/utilities permits.
- Egyptian Environmental Affairs Agency - EIA Central Department -(EEAA) - Regional Branch Office (EEAA)	Body responsible for receipt, review and approval of the EIA Report and, subsequently responsible for monitoring environmental compliance
Ras Gharib City Council	Issuing construction permits
Experts	
Migratory Soaring Birds Project	Protection of migratory birds in the area
Red Sea Protectorate	Environmental protection
Nature Conversation Egypt	Local Chapter of Bird Life International
Other Interested Parties	
Community development Non-governmental organizations (NGOs),	Environmental protection and representatives of the local community

8.3 Public Disclosure meeting

The public disclosure meeting has been carried out to present the results of the ESIA to the stakeholders and discuss the proposed mitigation measures. Stakeholders where invited to the meeting through personal invitations and a summary of the findings of the environmental and social impact assessment was prepared and sent to stakeholders with the invitation letters.

The meeting took place on Wednesday 4th of April, 2018 at CanCun Hotel in Ras Ghareb. Annex (2) presents the attendance sheets.

Presentations

A welcome speech was given by **Mr. Faisal Essa** – CEO of Lekela Egypt. In his speech he emphasized on the importance of encouraging Egypt's expansion of the renewable energy projects to meet the continuous drastic increase in the Egyptian market energy demand.

The following presentations included the project and company presentation by Ms. Jennifer Boca, where she presented the company and its projects around Africa where its focus is. The company presentation also expressed Lekela's commitment to engaging with all affected stakeholders including local community and implement a community investment strategy to ensure that the wind farm delivers maximum benefit to local stakeholders.

Following the company presentation, the results of the ESIA were presented by Environics including description of the project components and the surrounding environment as well as identification of the potential impacts and their recommended mitigation measures. Annex (3) includes the PC presentations.

After the presentations, Eng. Yasser Sherif - Environics moderated the discussions with the participants.

The topics raised by the attendees during discussions can be categorized as follows:

Impacts of the project on the environment

- Impacts on migratory birds

Impacts of the environment on the project

- Impact of Flash flood

Socio-economic aspects

- Labour and job opportunities
- Corporate Social responsibility
- Community engagement

Other issues

- carbon credit ownership
- Number of turbines and their technology
- Space between the turbines and rows
- Location and distance from main roads

Table (8-2) below presents details of the issues raised during the disclosure meeting and the discussions that have taken place.

Table (8-2): Summary of public inquiries and their response

Topic	Participants raising the issue	Inquiries/comments	Response
I) Impacts of the project on the environment			
Impact on migratory birds	Mr. Aref Farghaly – EEAA RBO Red Sea Governorate	- Proposed developing an early warning system with the purpose of controlling the shutdown periods	- It was clarified that the shutdown on demand is a main recommendation of the Lekela ESIA. In addition, the SESA of the whole wind park area also proposed shut down on demand as a suitable tool to minimize the lost time of operations.
	Eng. Mohamed Akmal - NREA	- Eng. Akmal indicated that the early warning system has been already implemented for the KFW project for two years using radars in cooperation with the Egyptian Armed forces in addition to human ground monitoring. He advised that so far, the utilization of radars has proved to be effective in the application of the shut down on demand scheme. It would be also considered to adopt the radar approach for NREA wind park project. The implementation of the shutdown on demand resulted in a total shutdown of a maximum of 90 minutes throughout the season.	
	Mr. Osama El Gebaly – Soaring Birds Project	- Mr. Osama advised that the CRM implemented for Lekela project showed results very similar to those of the CRM implemented by the soaring birds project. - He advised that Lekela comprehensive monitoring results for the four (five) seasons would support the SESA results and enable the authorities to take a properly informed decision to agree on the suitable shut down scheme. - Mr. Osama also praised Lekela's selection of turbine configuration which is based on using WTGs rated at 3.6MW which will result in minimizing the number of WTGs (70 WTGs) and thus reducing the barrier effect. This is different to Gebal El Zeit wind farm that uses 2 MW WTG resulting in increased numbers of turbines	

Topic	Participants raising the issue	Inquiries/comments	Response
	Mr. Makram Adly – El Mahaba NGO	- Mr. Makram inquired about the possibility to take certain measures to divert the migratory bird path away from the area	- It was clarified that the bird migration route in this area is one of the world's most important route which need to be protected and maintained. In this respect, the different wind project will take the necessary measures to minimize the potential negative impacts as much as possible.
Shutdown on demand vs Fixed Shutdown	- Eng. Eman Rashad - EETC	Eng. Eman emphasized that there is a common interest to optimize the shutdown scheme between the developer and EETC.	
Impact on soil	DR. Khaled Allam – Biodiversity Department - EEAA	- Dr. Allam highlighted the issue of desert biodiversity and that desert areas in general might have sensitivities which need to be considered	- It was clarified that such issues have b e e n considered in the ESIA report.
II) Impacts of the environment on the project			
Impact of Flash Flood	Mr. Ahmed Hazzawy – Nahded Baladna NGO	- Proposed construction of ponds upstream the project to collect the flood water to used it for agricultural purpose and other development activities	- It was clarified that previous experience showed that unplanned interventions to contain or divert the flood streams could result in destructive impacts on other developments in the area. Therefore, such proposals should be carefully studied and planned by the concerned authorities. - In addition, a key mitigation measure presented in the study is not to change the feature of the area and keep the area free of activities (such as agriculture or water ponds) that can attract any kind of biodiversity.
	- General: Yasser Shaaban – Head of Ras Ghareb City - Dr, Khaled Allam – EEAA, Department of Biodiversity	- The impact of flash flood need to be considered in the ESIA	It has been clarified that the flood intensity mapping for the project area has been presented in ESIA report showing that it lies close to high risk flood area to its northern and southern boundaries. The project site falls in a medium risk zone. However, the project site is located in an area of low flood intensity.

Topic	Participants raising the issue	Inquiries/comments	Response
III) Socio-economic aspects: Employment, Community involvement and services			
Community Engagement	- Eng. Amany Salah	- Emphasized the importance of community engagement throughout the life time of the project. This is to take place through assigning a community focal point responsible for establishing contact with the communities and receive potential community grievances.	-
Labour and job opportunities	- General. Yasser Shaaban _Head of Ras Ghareb City - Dr. Khaled Allam – EEAA Biodiversity Dept. - Mr. Mansour Mohamed – Head of Community Development NGO - Mr. Hussein Farrag – Environmental protection NGO - Mr. Makram Adly – El Mahaba NGO	- All stakeholders emphasized on the importance of providing sufficient job opportunities to Ras Ghareb communities and that the area has employment potential that could be trained to work within the renewable energy sector as many of them have been qualified to work in the oil and gas sectors. - Stakeholders also stressed on the importance of coordination with Ras Ghareb municipality and that the city is willing support in providing the required logistics for community training on renewable energy.	- Mr. Faisal Eissa clarified that Lekela employment policy is based on giving priority to the local workforce and construction contractors will be encouraged to hire workers from the local community. In addition, indirect job opportunities would be envisaged for local medium sized businesses to supply the majority of auxiliary components. It is expected that 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. - Mr. Faisal also indicated that there is potential for provision of professional training to the local communities to qualify them to work for Lekela project or other wind project throughout the country. - Eng. Eman Rahsad - EETC indicated that the electricity agreements with Lekela states that a minimum of 25% of the labour should be local. - Eng. Yasser Sherif – Environics also highlighted the key benefits to the project when hiring local labour which will result in eliminating the cost of provision of accommodation and transportation to the workers.

Topic	Participants raising the issue	Inquiries/comments	Response
	- General Yasser Shabaan – head of Ras Ghareb City	- Mr. Shabaan noted that there was a negative previous experience with similar project where promises were not fulfilled	- It was clarified that Lekela employment stresses on giving priority to qualified local communities and will encourage the contractors to utilize the qualifications suitable to the different project stages. In addition, communication and coordination with the Ras Ghareb city will be maintained throughout the project life time.
Community Services	- Mr. Hussein Farrag - Environmental protection NGO	- Inquired about the community support services that will be provided through the project	- It has been clarified that community needs could not all be addressed by one investor/project but should be addressed through collaborative efforts of the different developers. A number of potential opportunities for community development exist which could include Training and Infrastructure - It is of utmost importance that the means of community development is chosen and undertaken in full coordination with the governorate and local government entities.
	- Mr. Nour Nour – Nature Protection Association	**Proposed the following**: - Enhancing the capacity of local community to carry out the bird monitoring activities - Enhance the bird watching tourism in the area and provide the required infrastructure - Enhance educational tourisms through establishing an educational and/or bird research Centre in the area	
IV) Other issues			
Carbon Credit	- Mr. Aref Farghaly – EEAA RBO – Red Sea Governorate	Inquired about the ownership of the carbon credit	Eng. Eman Rashed – EETC indicated that according to electricity purchasing agreement it is 50/50 distribution between the Government and the project

Topic	Participants raising the issue	Inquiries/comments	Response
Project layout	- General Yasser Shaaban- head of Ras Ghareb City	Inquired about: - Number of turbines and their technology - Space between the turbines and rows - Location and distance from main roads	It was indicated that the project description and dimensions are provided in the different studies submitted to the authorities and will be provided in detail to the municipality within the process of obtaining the required construction permits and that the main project configuration is as follows: – Number of turbines = 70 WTG – distance between WTG equals 3 times the rotor diameter – distance between WTG rows is 8 times the rotor diameter – the distance from the main road is about 7km

8.4 Ongoing Consultation during project development and operation

The objective of the consultation is to support the Stakeholder Engagement on issues of concern and enable all stakeholders to have their interests considered during the project entire lifetime. To this end, the project has developed a Stakeholder Engagement Plan. Details of the plan will be provided to the community and other stakeholders.

The consultation is essential to:

- Keep those affected by the project informed of work progress and related changes
- Managing issues and grievances as they arise
- Monitoring the effectiveness of environmental and social mitigation measures

8.4.1 Public Consultation Meetings during the Project Lifetime

Continuous communication will be maintained with stakeholders regarding different issues, such as:

- Providing information to stakeholders on project development,
- Obtaining public feedback, and
- Coordinating community development objectives.

Follow-up on feedback, management tasks, agreements or commitments will be made. If commitments are made, responsibilities must be defined and a timeline estimated for carrying out these commitments. Actions will be initiated and follow-up will be undertaken and reported to the concerned stakeholder.

8.4.2 Grievance System

The project has developed a Grievance Mechanism accessible to the stakeholders that will allow them to address their comments, worries and complaints.

An effective grievance mechanism will be functioning throughout the project lifetime and available to affected communities at no cost. The grievance system will allow direct communication between the community and project management at any time, independently of the meeting schedules. This will likely involve a combination of avenues, such as telephone, mail, emails, oral communication through meetings, etc.

Grievance related to any aspect of a project will be resolved through consultations conducted in a transparent manner with the goal of reaching consensus.

A computerized data-base would be established to record all grievances/complaints and the completion date in which the complaint was closed/corrected. This will include the suggested actions, date to be completed by, date it was completed by and the effectiveness of the

response. Once the data base is established, staff will be trained and will be required to use the data-base.

The project will publicize the grievance system and how it works among project affected people. The response time between activating the procedures and reaching a resolution should be as short as possible.

References

Arnold, C. (2015-07-30). "Meet the First New Canine Found in 150 Years". National Geographic. Retrieved 2015-08-02.

Baha El Din, S. (1999) *Directory of Important Bird Areas in Egypt*. BirdLife International, The Palm Press, Cairo: 113 pp.

Basuony, M.I.; Gilbert, F. and Zalat S. (2010) *Mammals of Egypt. Atlas, Red Data Listing and Conservation*. Ministry of State for Environmental Affairs.

Boulos, L. (1999) *Flora of Egypt*. Vol. I (Azollaceae- Oxalidaceae). Al-Hadara Publishing, Cairo, Egypt: 419 pp.

Boulos, L. (2000) *Flora of Egypt*. Vol. II (Geraniaceae- Boraginaceae). Al-Hadara Publishing, Cairo, Egypt: 352 pp.

Boulos, L. (2002) *Flora of Egypt*. Vol. III (Verbenaceae- Compositae). Al-Hadara Publishing, Cairo, Egypt: 373 pp.

Boulos, L. (2005) *Flora of Egypt*. Vol. IV Monocotyledones (Alismataceae - Orchidaceae). Al-Hadara Publishing, Cairo, Egypt: 617 pp.

Boulos, L. (2009) *Flora of Egypt: Checklist*. Revised Annotated Edition. Al-Hadara Publishing, Cairo, Egypt: 410 pp.

Bruun, B. and Baha El Din S. (2002) *Common Birds of Egypt* (Revised Edition). The American University in Cairo Press, Cairo, Egypt.

Cox, N., J. Chanson and S. Stuart (2006) The Status and Distribution of Reptiles and Amphibians of the Mediterranean Basin. http://data.iucn.org/dbtw-wpd/edocs/2006-027.pdf.

Cuzin, F., Lenain, D.M., Jdeidi, T., Masseti, M., Nader, I., de Smet, K. and Murdoch, J. (2008). *Vulpes rueppellii*. The IUCN Red List of Threatened Species 2008: e.T23053A9411846. http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T23053A9411846.en. Downloaded on 29 October 2015.

Drew, C., O'Donovan, D., Simkins, G., Al Dosary, M., Al Khaldi, A.M., Mohammed, O.B., Al Nuaimi, A.S.M., Al Mutairi, M.S., Al Habhani, H.M., Sami Amr, Z., Qarqas, M. and Abu Baker, M.A. (2008). *Lepus capensis*. The IUCN Red List of Threatened Species 2008: e.T41277A10429185. Downloaded on 29 October 2015.

EEAA/DANIDA/Governorate of Suez (2004) The Environmental Profile of the Governorate of Suez, Egypt.

EEAA/UNEP (1993) *Habitat Diversity: Egypt*. Publications of the National Biodiversity Unit, 1, EEAA, Cairo: 302 pp.

EEAA/UNEP (1995) Egypt Country Study on Biological Diversity. Publications of the National Biodiversity Unit, 3, EEAA, Cairo: 234 pp.

Environics (2006) Environmental Baseline Survey of Area "A", Eastern Desert (Final Report). Oil Search Limited.

Environics (2014) ESIA for Seismic Acquisition for North West Gharib, South West Gharib and South East Gharib Concessions in the Eastern Desert of Egypt (Final Report). TransGlobe Energy Egypt.

Environics and Baha El Din (2016) Report on the spring 2016 Pre-construction Ornithological Monitoring at the Lekela Project Site, Ras Gharib, Gulf of Suez. Prepared for Lekela Egypt

Environics and Hemaya (2016) Autumn 2015 Pre-construction Ornithological Monitoring at the Lekela project site, Ras Gharib, Gulf of Suez. Prepared for Lekela Egypt

Environics and NCE (2017a) Report on the spring 2017 pre-construction ornithological monitoring at the Lekela wind energy development area, Ras Gharib, Gulf of Suez. Prepared for Lekela Egypt

Environics and NCE (2017b) Report on the autumn 2017 pre-construction ornithological monitoring at the Lekela wind energy development area, Ras Gharib, Gulf of Suez. Prepared for Lekela Egypt

Gaucher, P.; Petit, T.; Symens, P. (1988) Notes on the study of the Sooty Falcon (*Falco concolor*) during its breeding season in Saudi Arabia. *Alauda* 56(3): 277-283.

GEF (1997) Egyptian Red Sea Coastal and Marine Resource Management Project, Baseline Report. GEF/TDA/EEAA

Hoath, R. (2003) *A Field Guide to the Mammals of Egypt*. The American University in Cairo Press, Cairo, Egypt.

IUCN (2016) IUCN Red List of Threatened Species (Database). http://www.iucnredlist.org/

Kassas and Imam (1954) Habitat and Plant Communities in the Egyptian Desert: III. The Wadi Bed Ecosystem. *Journal of Ecology*, 42(2):424, July 1954

Koepfli, K.-P.; Pollinger, J.; Godinho, R.; Robinson, J.; Lea, A.; Hendricks, S.; Schweizer, R. M.; Thalmann, O.; Silva, P.; Fan, Z.; Yurchenko, A. A.; Dobrynin, P.; Makunin, A.; Cahill, J. A.; Shapiro, B.; Álvares, F.; Brito, J. C.; Geffen, E.; Leonard, J. A.; Helgen, K. M.; Johnson, W. E.; O'Brien, S. J.; Van Valkenburgh, B.; Wayne, R. K. (2015-08-17). "Genome-wide Evidence Reveals that African and Eurasian Golden Jackals Are Distinct Species". *Current Biology* 25: 2158–65.

Lahmeyer International and Ecoda (2017) Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez, 2nd Draft Report (D-5-2), prepared for RCREEE – Regional Centre for Renewable Energies and Energy Efficiency

Mebs, T. and Schmidt, D. (2006) Die Greifvögel Europas, Nordafrikas und Vorderasiens. Kosmos Verlag.

NREA (2013) Environmental and Social Impact Assessment for an Area of 300 km² at the Gulf of Suez. Prepared by Joint venture Lahmeyer International GmbH, Bad Vilbel and Ecoda Dr. Bergen & Fritz GbR, Dortmund, Germany. Financed by Arab Fund for Economic & Social Development

Raunkiaer, C. (1937) Plant life forms. Clarendon, Oxford, 104 pp.

Saleh, M.A. (1997) *Amphibians and Reptiles of Egypt*. Publications of the National Biodiversity Unit, 6, EEAA, Cairo: 234 pp.

Schleich, H.H., Kästle, W. and Kabisch, K. (1996) *Amphibians and Reptiles of North Africa: Biology, Systematics, Field Guide*. Koeltz Scientific Books, Koenigstein.

Tharwat, M.E. (1997) *Birds Known to Occur in Egypt*. Publications of the National Biodiversity Unit, 8, EEAA, Cairo: 204 pp.+xxi+XIX

Vernet, Roland, Michel Lemire, Claude J. Grenot, and Jean-Marc Francaz. (1988) Ecophysiological comparisons between two large Saharan Lizards, *Uromastyx acanthinurus* (Agamidae) and *Varanus griseus* (Varanidae). *Journal of Arid Environments* 14:187–200.

Wilms, T.; Wagner, P.; Shobrak, M.; Lutzmann, N. and Böhme, W. (2010) Aspects of the ecology of the Arabian spiny-tailed lizard (*Uromastyx aegyptia microlepis* Blanford, 1875) at Mahazat as-Sayd protected area, Saudi Arabia. *Salamandra* 46(3) 131–140

Wilms, T., Eid, E.K.A., Al Johany, A.M.H., Amr, Z.S.S., Els, J., Baha El Din, S., Disi, A.M., Sharifi, M., Papenfuss, T., Shafiei Bafti, S. & Werner, Y.L. (2012). *Uromastyx aegyptia*. The IUCN Red List of Threatened Species 2012: e. T164729A1071308. Downloaded on 29 October 2015.

Annex (2): Presents the attendance sheets

Public Consultation

Lekela Wind Project – Ras Ghareb

No.	Name	Location	Tel. No.	Email
1.	Mohamed Dandarawy Mohamed	General Manager of Safety and Environmental Protection - Dara Petroleum Company	01002553046	mdandrawy@petrodara.com.eg
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4.	Soliman Rafia Salama	Local community - Al-Maazah tribe		
5.	Hammad Aaid Soliman	Local community - Al-Maazah tribe		
6.	Eid Rafia Salama	Local community - Al-Maazah tribe		
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12.	Ahraf Abd El Hamid	Environmental Management Unit of Ras Ghareb City	01006353930	

No.	Name	Location	Tel. No.	Email
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20.	Hala Ahmed Tahir	Director of Society for Community Development in Telefzion	01006833528	
21.	Mansour Mohamed Mahmoud	Chairman of the Board of Directors of the Community Development Society NGO at Telefzion	01095747376	
22.	Osama Marzok Botros	Treasurer of the Community Development Association NGO at Telefzion	01283923421 - 01002161470	
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No.	Name	Location	Tel. No.	Email
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31.	General \Yasser Shaban	Mayor of Ras Ghareb	0106050446	
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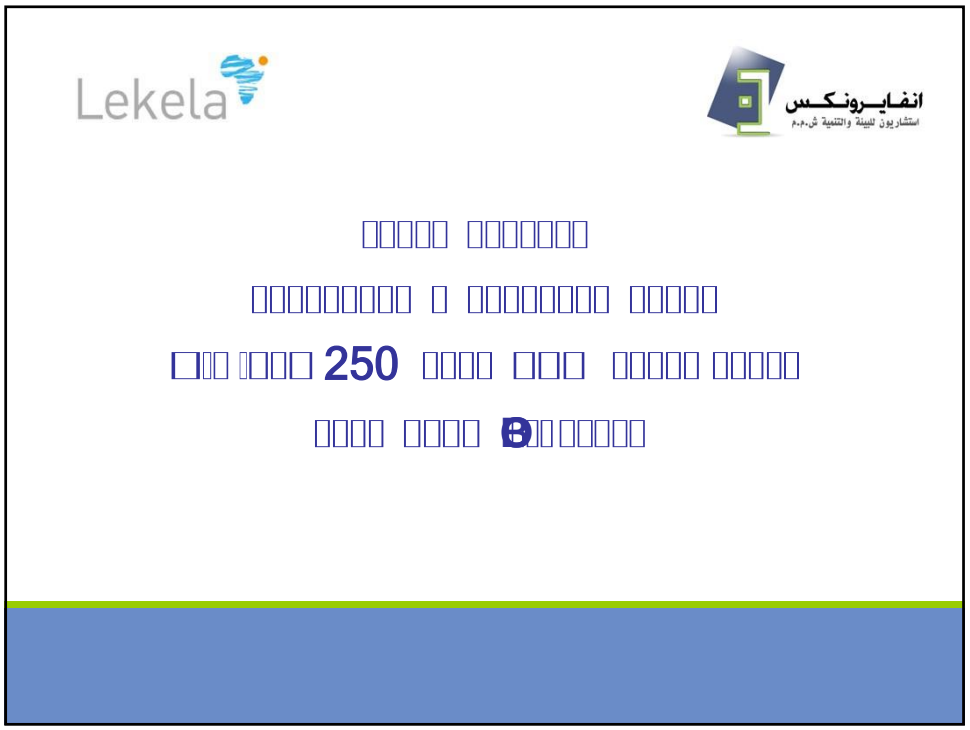
34.	Ahmed Abd El Hadi	Nahdet Baladna Association- NGO		
35.	Mohamed Said Ebrahim	Nahdet Baladna Association- NGO		

Annex (3): Includes the PC presentations



سبق هذا الاجتماع

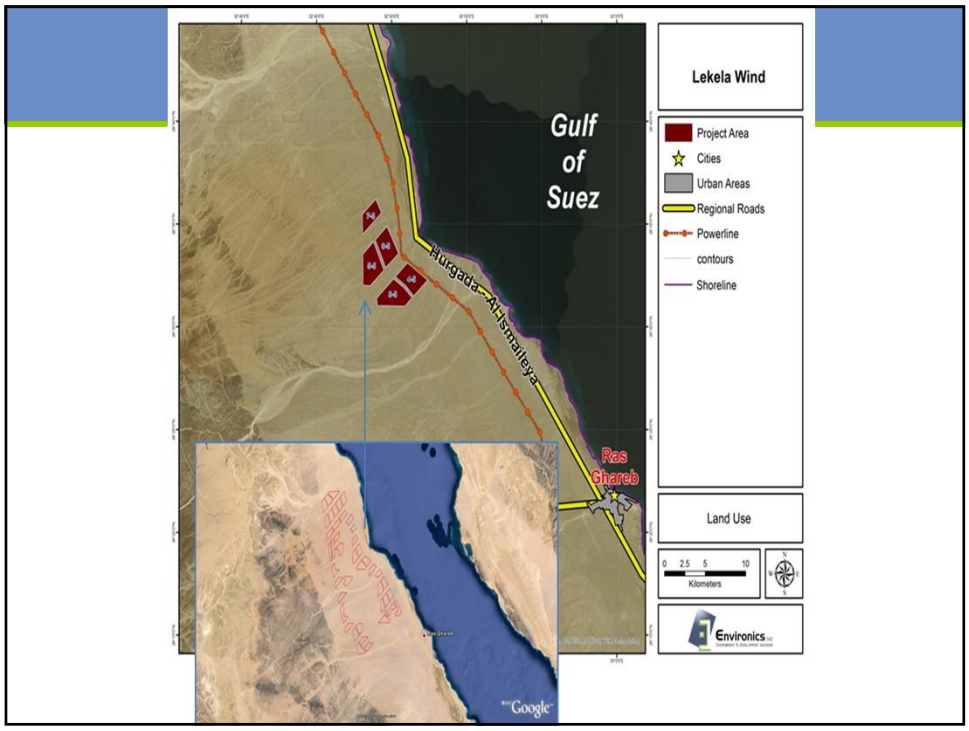
- سبق هذا الاجتماع جلسة تشاور فى أكتوبر 2017 لعرض نتائج الدراسة الاستراتيجية لمجمع محطات طاقة الرياح و تم إعدادها من خلال المركز الإقليمى للطاقة المتجددة وكفاءة الطاقة RCREEE
- الغرض من هذا الاجتماع هو عرض نتائج دراسة تقييم التأثيرات البيئية والاجتماعية لمشروع ليكيلا بغرض تقديم الدراسة لجهاز شئون البيئة كدراسة منفصلة.

□□□□□ □□□□

- مكونات المشروع
- الدراسات البيئية الأساسية
- نتائج دراسة تقييم التأثيرات البيئية للمشروع
- الخلاصة
- مناقشة عامة

□□□□□ □□ □□□□□

- تعتزم شركة "ايكيال مصر" إنشاء محطة لتوليد كهرباء تعمل بطاقة الرياح بقدرة 250 ميجاوات داخل مجمع محطات طاقة الرياح بشمال رأس غارب
- يقع المشروع داخل المنطقة المخصصة لهيئة الطاقة الجديدة والمتجددة لإقامة مجمع محطات طاقة الرياح بشمال رأس غارب على مساحة 328 كيلو متر مربع.
- ستشغل محطة الرياح المقترحة 5 قطع أراضي داخل مجمع محطات طاقة الرياح



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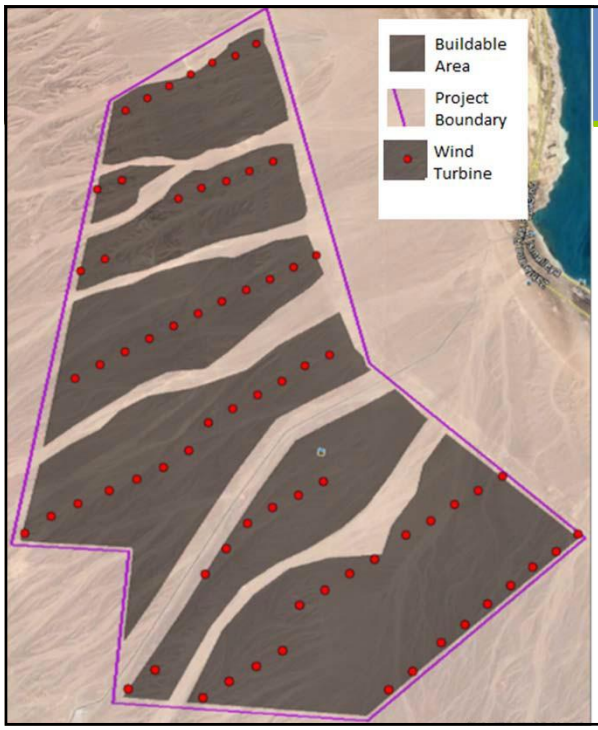
- يتكون مشروع محطة الرياح المقترحة من 70 مولد توربينات رياح مستقل.
- وتتضمن المكونات الأساسية لمحطة الرياح الأجزاء الأساسية التالية:

– توربينات الرياح وأساساتها

– غرف المحولات (محولات أرضية): ملحقة بالتوربينات حيث يتم رفع الطاقة الكهربائية منخفضة الجهد إلى كهرباء متوسطة الجهد، وتوجيهها إلى محطة المحولات الكهربائية بالموقع.

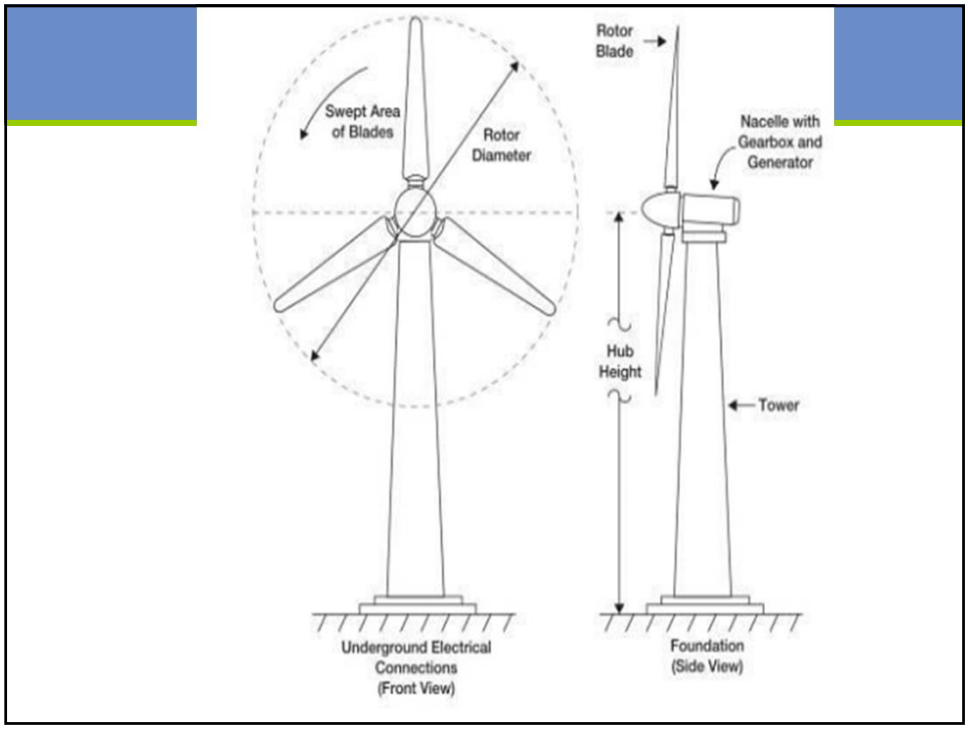
– نظام تجميع الجهد المتوسط، ويتكون من كابلات أرضية تربط التوربينات وتربطها مع مبني التحكم الكهربائي بالموقع.

– ثالث أبراج/ صواري دائمة لألرصاد الجوية.



المخطط المقترح لوضع التوربينات

- يشتمل المخطط على عدد 70 توربين بقدرة 3,6 ميجاوات.
- أقصى ارتفاع للتوربينة
- تبلغ أقل مسافة بينية بين التوربينات حوالي 3 قطرمروحة
- تبلغ أدنى مسافة بينية ما بين صفوف التوربينات المتجاورة حوالي 8 قطرمروحة



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- أعمال الأساسات والهياكل المعدنية مكونة من حوالي 400 م3 من الخرسانة المسلحة.

- تقوم الشركة المصرية لنقل الكهرباء بإنشاء خط رئيسي كهرباء هوائي بقدرة 220 كيلوفولت للتوصيل على محطة محولات كهربائية بقدرة 500 كيلوفولت/ 200 كيلوفولت حيث يتم زيادة الجهد بقدر أكبر ويتم نقل الطاقة الكهربائية المنتجة إلى شبكة النقل التابعة للشركة المصرية لنقل الكهرباء.

- **مبني التشغيل والصيانة**: يشتمل على نظام دائم لإمداد المياه وصلات لنظام بيارة الصرف.

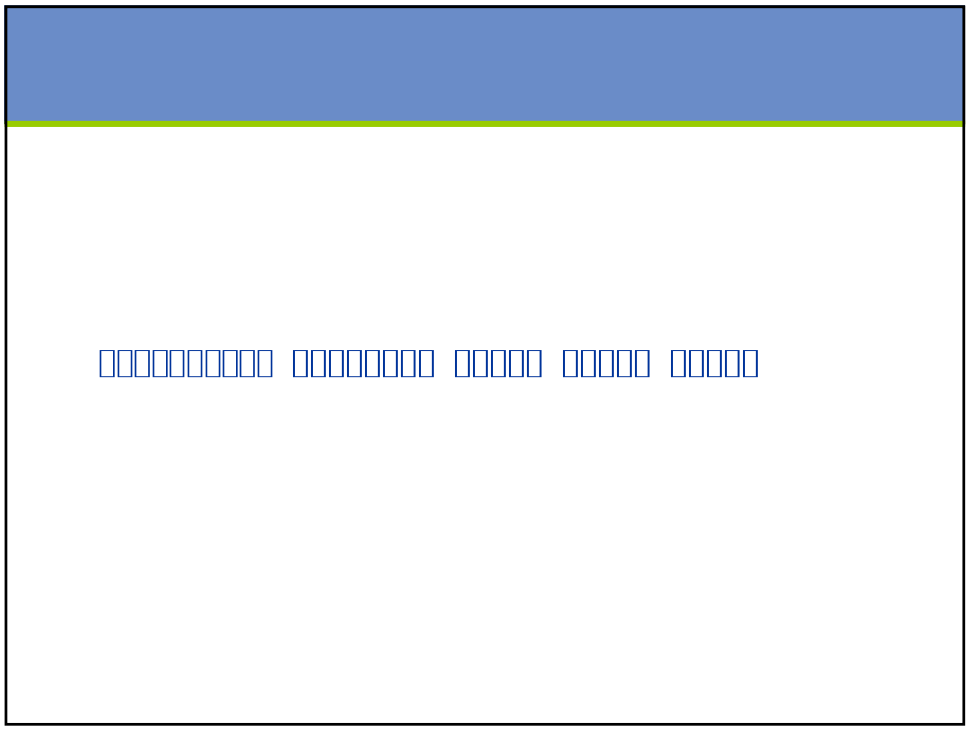
- **خزان مياه** : خلال مرحلة الإنشاء، من المقرر إمداد مياه للاستخدامات الآدمية وأعمال الخرسانة والتى يتوقع أن يتم توفيرها من خلال مقاول يتم التعاقد معه.

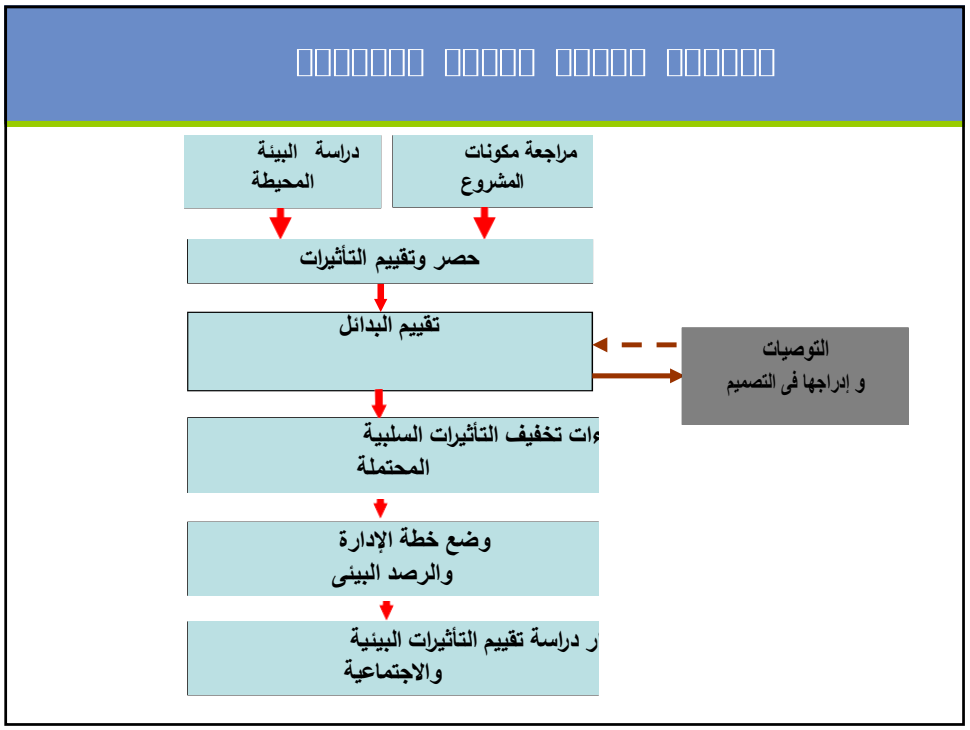
- **بيارة الصرف:** خزان صرف صحي (بيارة) لتجميع معالجة مياه الصرف ويتم نزح الخزان بواسطة مقاولين مصرح لهم نقل مياه الصرف ومعتمدون من المحافظة.

العدد التقريبي للعمالة

- يتوقع أن توفر مرحلة الإنشاء نحو 300 فرصة عمل من العمالة المؤهلة وغير ة فى مرحلة ذروة الأعمال. وستقوم الشركة بتشجيع المقاولين على تعيين العاملين من المجتمعات المحلية متى كانت مؤهلاتهم مناسبة

- من المتوقع أن يبلغ عدد العاملين الدائمين بالموقع أثناء التشغيل 12 عامل




دراسة البيئة المحيطة
مراجعة مكونات المشروع
حصر وتقييم التأثيرات
تقييم البدائل
التوصيات
و إدراجها فى التصميم
المحتملة
وضع خطة الإدارة
والرصد البيئى
والاجتماعية

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- **دراسات الوضع البيئى الحالى**

البيئة الطبيعية –

البيئة الاجتماعية والاقتصادية –

البيئة الحيوية متضمنة نتائج رصد الطيور المهاجرة لأربعة مواسم وتجرى حاليا أعمال الرصد للموسم الخامس فى الموقع

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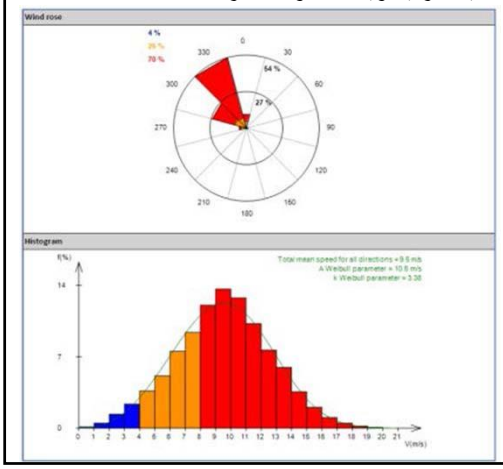
الرياح •

الرياح السائدة معظم شهور السنة هي رياح شمالية غربية ويصل متوسط سرعة الرياح فى المنطقة إلى 9.5 م/ث



Source: Strategic and Cumulative Environmental and Social Assessment Active Turbine Management Program (ATMP) for Wind Power Projects in the Gulf of Suez 2nd Draft Report (D-5-2) on the Strategic Environmental and Social Assessment-August 2017

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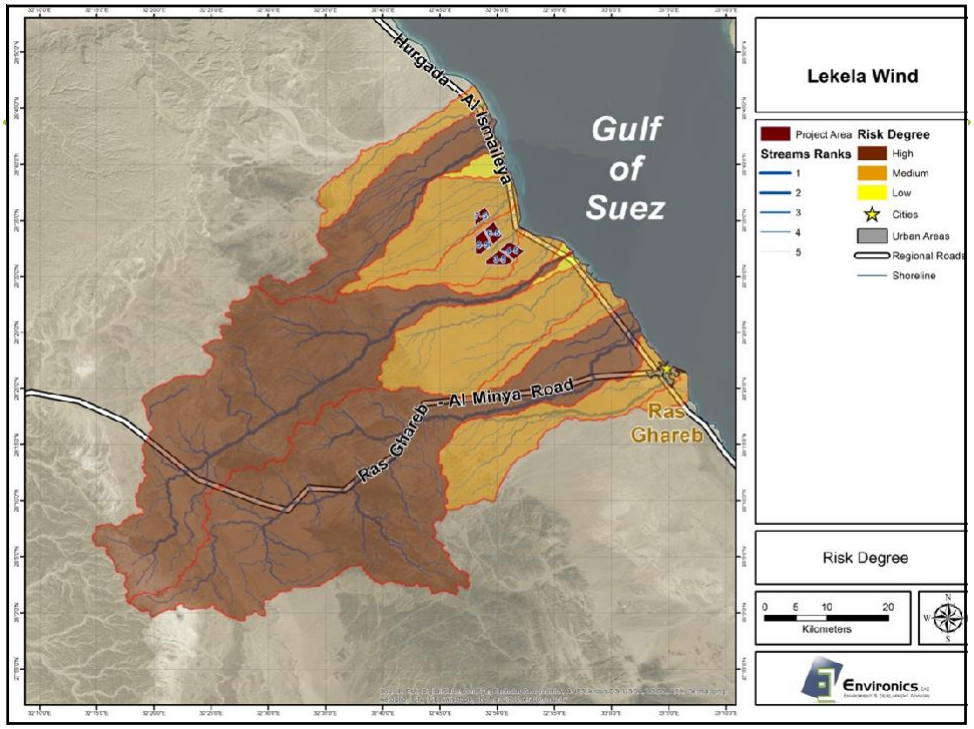
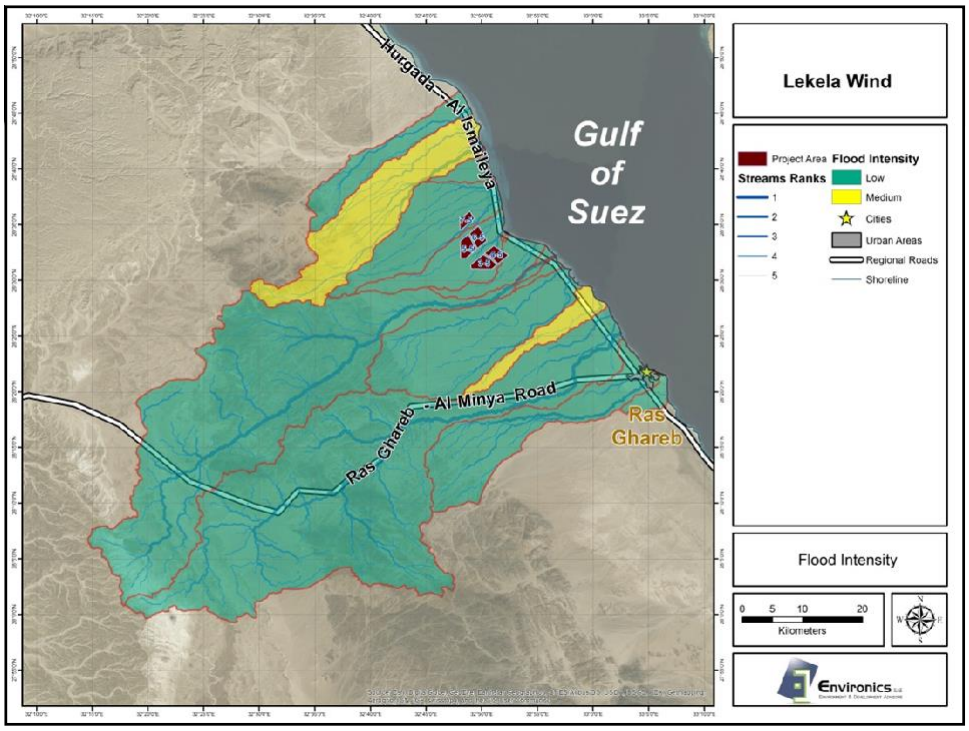
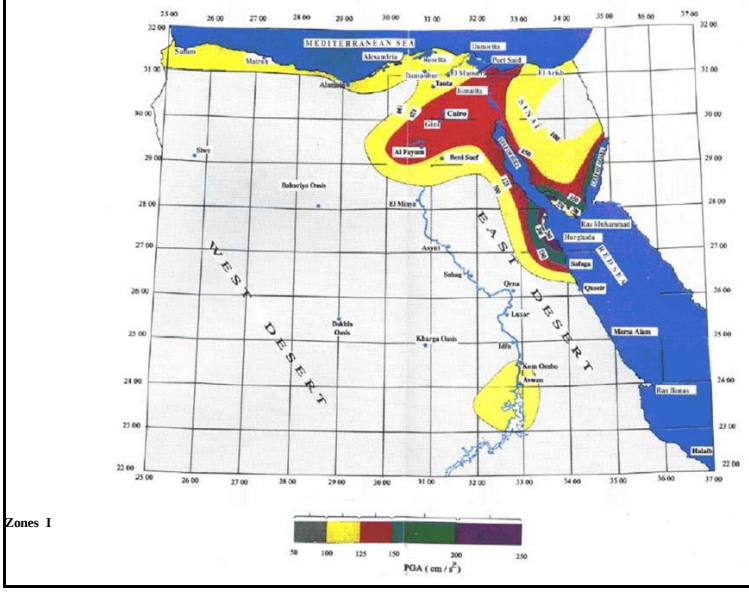
- ال توجد مجارى أو مسطحات مائية عذبة دائمة في المنطقة. غير أن هناك مخرات سيول تتجمع من خاللها مياه المطار في بعض الحيان بدءا من جبال الصحراء الشرقية حتى تصل إلى البحر

- موقع المشروع يقع بالقرب من مجرى سيل يقع على حدوده الشمالية والجنوبية.




Hurgada – Al Ismaileya
Gulf of Suez
Ras Ghareb – Al Minya Road
Ras Ghareb
Lekela Wind
Project Area
Flood Intensity
Streams Ranks
Low
Medium
1
2
3
4
5
Cities
Urban Areas
Regional Roads
Shoreline
Flood Intensity
0 5 10 20
Kilometers
Environics

الزلازل


MEDITERRANEAN SEA
Alexandria
Cairo
Giza
Suez
Al Fayum
Beni Suef
Bahariya Oasis
El Minya
Asyut
Sohag
Qena
Luxor
Dakhla Oasis
Kharga Oasis
Idfu
Kom Ombo
Aswan
Marsa Alam
Ras Banas
Halaib
Hurghada
Safaga
Quseir
RED SEA
SINAI
WEST DESERT
EAST DESERT
Zones I
50 100 125 150 200 250
PGA (cm / s²)

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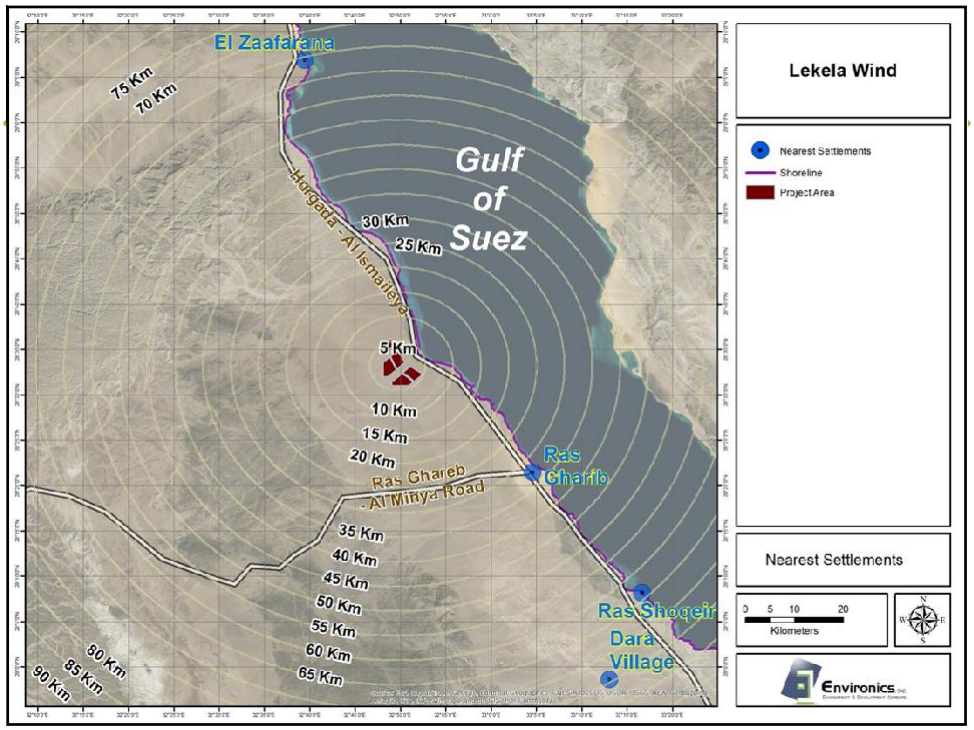
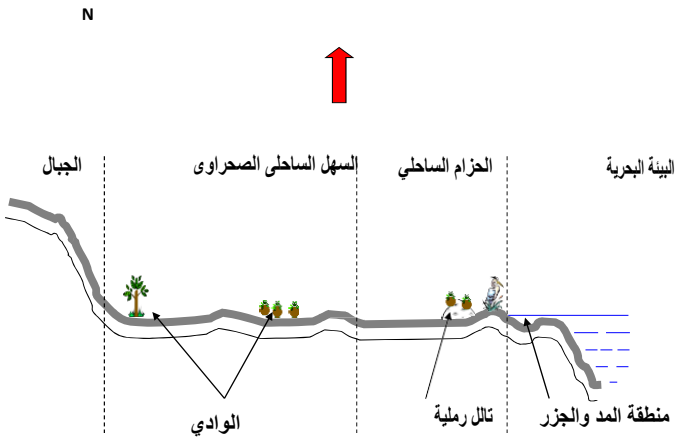
يقع المشروع فى منطقة صحراوية لا يوجد بها أي تجمعات سكنية ويقع الموقع – جنوب مناطق الامتياز الخاصة بشركات البترول.

تقع أقرب مدينة، وهي مدينة رأس غارب، علي بعد مسافة 28 كيلو متر من – موقع المشروع.

يعتبر قطاع البترول من أهم الأنشطة الاقتصادية فى المدينة –



- **البيئة البيولوجية**
- تنقسم المنطقة بيئياً/ إيكولوجياً إلي ثلاثة نظم بيئية أرضية رئيسية هي:
  - الجبال الساحلية
  - السهل الساحلي الصحراوي و
  - الحزام الساحلي بما في ذلك المستنقعات الساحلية المالحة.
- يقع مشروع ليكيلا فى نطاق السهل الساحلى الصحراوى
- يتكون الموقع من ركيزة رملية مغطاة بالحصى والحجارة والصخور ولا يوجد انخفاضات يمكن أن تتراكم،بها مياه تسمح بنمو الغطاء النباتي. ونتيجة لذلك فإن موقع ليكيلا خال تماما من الغطاء النباتي.



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: تم النظر في تقييم التأثيرات على الجوانب التالية

- □□□□□□ □□□ □□□□□□□□
  - التربة
  -)المياه (الجوفية والسطحية
  - بيئة البيولوجية نوعية
  - الهواء الضوضاء
  - إدارة المخلفات
  - المرور
  - العمالة والتأثيرات االقتصادية
  - الصحة العامة
  - الصحة المهنية
  -

- **التأثيرات على المشروع**
  - السيول
  - الزلازل

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جوانب تم استبعادها	أسباب الاستبعاد
• • والجوفية	• السطحية أو الجوفية

□□□□□□□□

م	التأثيرات البيئية	ملحوظ غير	إيجابية	ضئيلة	أهمية ذات
	مرحلة الإنشاء				
1	نوعية الهواء	●		●	
2	الضوضاء الخارجية	●			
3	التربة			●	
4	العمالة والتأثيرات الاقتصادية		●		
5	بيئة العمل			●	
6	إدارة المخلفات			●	
7	الصحة العامة	●			
8	المرور			●	

□□□□□□□□

م	التأثيرات البيئية	ملحوظ غير	إيجابية	ضئيلة	أهمية ذات
	مرحلة التشغيل				
1	الضوضاء الخارجية	●			
2	إدارة المخلفات			●	
3	بيئة العمل			●	
4	)التأثيرات علي المجتمعات المحيطة (العمالة		●		
5	الزلازل			●	
6	السيول			●	

النشاط	نوع التأثير	ملخص تدابير التخفيف	للتنفيذ الجهة المنفذة للنشاط/المدى	التأثير المتبقي
مرحلة الإنشاء				
نوعية الهواء الخارجي 1-				
• انبعاثات احتراق الوقود من مولدات انبعاثا • ت الأتربة أثناء أنشطة الديزل .الإنشاء	غير ملحوظ	• صيانة المعدات والمركبات وضع حد أقصى للسرعة داخل الموقع • استخدام أساليب مناسبة لاخماد الأتربة، عند الحاجة إلى ذلك	مقاول الإنشاء/طوال مرحلة الإنشاء	/غير ذات أهمية يكاد لا يذكر
الضوضاء 2-				
• ال الحفر • المعدات والآلات	غير ملحوظ	• الحفاظ علي المعدات والآلات في اعتماد نظام • .الشكاوى المتعلقة حالة تشغيل جيدة بالضوضاء الناجمة عن أنشطة الإنشاء، إن وجدت	مقاول الإنشاء/طوال مرحلة	يكاد لا يذكر غير ذات /أهمية
التربة والمخلفات 3-				
• البيارات • انسكابات الوقود وتسربات الزيت • مخلفات الإنشاء	طفيف	• الإدارة المناسبة لمياه الصرف .والمخلفات البلدية • الإدارة السليمة للزيوت المستخدمة .للتقليل من تسربها للتربة	مقاول الإنشاء/ طوال مرحلة الإنشاء المطورين (يشمل بنود في عقود .الإنشاء)المطورين لضمان التزام المقاولون	غير ذات أهمية

النشاط	نوع التأثير	ملخص تدابير التخفيف	ى للتنفيذ الجهة المنفذة للنشاط/ المدى	التأثير المتبقي
القوة العاملة والصحة والسلامة ببيئة العمل 1-				
• الصحة والسلامة ببيئة العمل	طفيف	• الالتزام باللوائح المحلية الخاصة بالسلامة والصحة المهنية، قانون رقم 2003/12. • توفير معدات الوقاية الشخصية المناسبة، والتدريبات إجراء فحوصات السلامة بشكل مستمر • .إجراء الصيانة الدورية للمعدات	مقاول الإنشاء/قبل وأثناء مرحلة الإنشاء	غير ذات أهمية
الاجتماعية الاقتصادية 2-				
• التوظيف والعمالة	إيجابي	• توفير فرص عمل للمجتمعات المحلية وغالباً ما تكون أثناء .مرحلة الإنشاء	مقاول الإنشاء/ المطور	إيجابي
• المرور	غير ملحوظ	• خطة الإدارة المرورية	بل بدء الإنشاء مقاول الإنشاء/ المطور	غير ذات أهمية

النشاط	نوع التأثير	تدابير التخفيف	الجهة المنفذة للنشاط/	التأثير المتبقي
التشغيل				
تأثيرات الضوضاء				
تشغيل المراوح	غير ملحوظ	•تصميم الآلات لتفي بمتطلبات اللوائح القانونية المتعلقة بالضوضاء. •توفير مهام الوقاية الشخصية المناسبة للعاملين •اعتماد نظام الشكاوى المتعلقة بالضوضاء	المطور/أثناء التشغيل	غير ذات أهمية
التربة والمخلفات				
• البيارات • تسربات الزيت نتيجة عمليات الصيانة • المخلفات الصلبة	غير ملحوظ	•الإدارة السليمة لمياه الصرف والمخلفات البلدية •الإدارة السليمة للزيوت المستخدمة.	المطور/المقاول المسئول عن إدارة المخلفات طوال مرحلة التشغيل	غير ذات أهمية
القوة العاملة والصحة والسلامة ببيئة العمل 2-				
• الصحة والسلامة ببيئة العمل	غير ملحوظ	•الالتزام بقانون رقم 2003/12. •توفير معدات الوقاية الشخصية المناسبة، •إجراء الصيانة الدورية للمعدات	المطور/طوال مرحلة التشغيل	غير ذات أهمية
الاجتماعية الاقتصادية 3-				
• التوظيف والعمالة	إيجابي	•توفير فرص عمل للمجتمعات المحلية	المطور	إيجابي

[illegible]

- إعداد سجل بيئى طبقا لقانون /4 1994
- إعداد وتنفيذ خطة الرصد الذاتى -ضوضاء(بيئة -عمل)انبعاثات أثناء مرحلة الإنشاء
- خطة ادارة المخلفات
- خطط تدريب وتوعية العاملين
- خطة للسلامة والصحة المهنية

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One of the large flocks of Garganey observed over the study site on 25September 2017. Photo Ali Dora.

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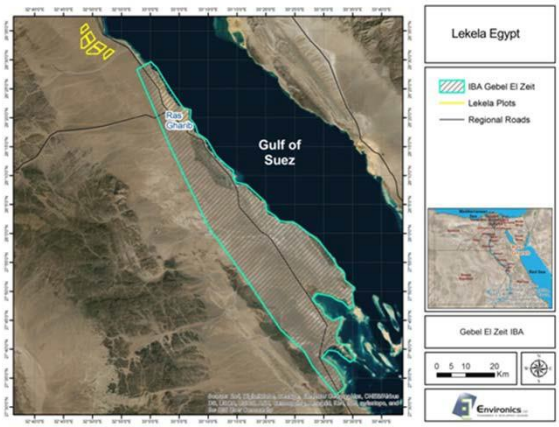

- تصنف الهيئة العالمية (BirdLife International) الشريط الضيق البالغ 100 كيلو متر الممتد من رأس غارب شمالاً إلي خليج غبة الجمسة جنوباً كمنطقة هامة للطيور (IBA)

- يعتبر هذا الشريط من أهم مسارات هجرة الطيور في العالم

- يقع المشروع شمال هذه المنطقة

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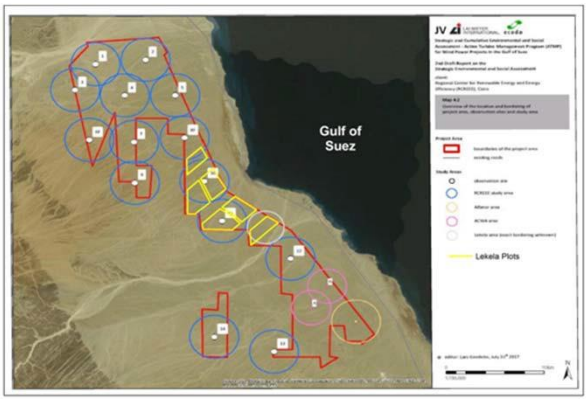

- قام المكتب الاستشاري Lahmeyer International and Ecoda بإجراء رصد للهجرة الموسمية للطيور لمدة موسمين هجرة فى نطاق مجمع المحطات بالتعاون مع المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة، كجزء من الدراسة الاستراتيجية لتقييم التأثيرات البيئية والاجتماعية لمجمع محطات الرياح

[illegible]

- ركزت الدراسة الاستراتيجية على أنواع الطيور الحوامة كبيرة الحجم (الأنواع المستهدفة) حيث أن قدرة هذه الطيور على المناورة أقل، فهي أكثر عرضة للمخاطر المحتملة عن محطات الرياح

- اشارت نتائج الدراسة إلى أن هجرة الطيور فى فصل الخريف فى منطقة الدراسة أقل أهمية من تلك التى فى فصل الخريف.

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- إضافة إلى أنشطة الرصد فى إطار الدراسة الاستراتيجية أدار المكتب الاستشارى إنفايرونكس بالتعاون مع "**حماية**" و"**الجمعية المصرية لحماية الطبيعة**" **نهاء الذين** عددًا من الدراسات لتفصيلية لهجرة الطيور الموسمية والتى استهدفت موقع مشروع شركة ليكيلا كالآتى:
  - خريف 2015: من 16 أغسطس إلى 5 نوفمبر
  - ربيع 2016: من 10 فبراير إلى 15 مايو
  - ربيع 2017: من 20 فبراير إلى 15 مايو
  - خريف 2017: من 15 أغسطس إلى 5 نوفمبر

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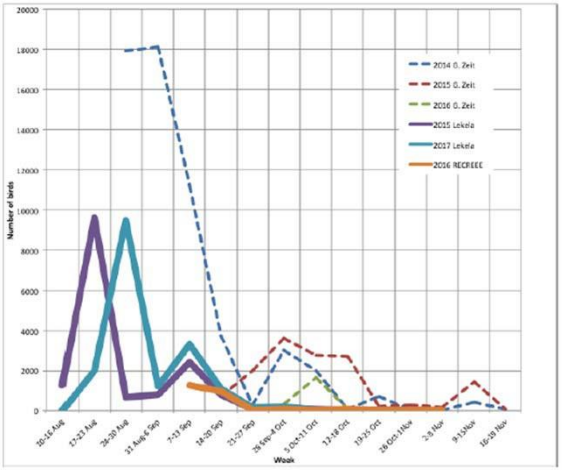
الطيور **)الظروف المناخية (كل ساعة**

- العدد
- سرعة الرياح
- ألأنواع
- اتجاه الرياح
- الارتفاع
- مدى الرؤية
- االتجاه
- الحرارة
- زمن البقاء داخل المنطقة
- أى ظروف خاصة

- رصد كل انواع الطيور ونركز فى العرض على الطيور الحوامة لكونها أكثر عرضه للمخاطر

- اشارت نتائج الرصد أن فصل الربيع أكثر أهمية من الخريف مما يؤكد نتائج الدراسة الاستراتيجيةوان كان الخريف ما زال يحتاج ألى نظام لإدارة المخاطر

•وقد تكون نتائج الدراسة الاستراتيجية مبنية على ما رصدته من طيور فى فصل الخريف الذى بدأ الرصد به متأخرً



G.Zeit 2014 (Ecoconserve 2015), 2015 (Ameaster 2016) and 2016 (Baha El Din 2016) at the 240 MW wind farm at Gebel El Zeit (dotted lines); and the autumn of 2015 (Environics 2016) and this study (2017) at the Lekela study site ; plus the RECREEE Strategic Study (Lahmeyer & Ecoda 2017).

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- تنوع عالى نسبيا ولم تقل الأنواع عن 25 فى أى من المواسم
- تمثل سبعة أنواع أكثر من 95% فى أغلب المواسم
- هو أكثر Stork White اللقلق الأبيض الأنواع مرورًا بالمنطقة، يليه عقاب السهول Steppe Eagle ، ثم حوام النحل الأوروبي European Honey Buzzard Black والبجع االبيض White Pelican و الحدأة السوداء Kite
- فى Stork Black ظهر اللقلق االسود موسم واحد بأعداد كبيرة

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- ظهرت بعض الأنواع المهددة لكن بنسب قليلة من التعداد التقديرى للمسار
- الذى مثلت أعداده Eagle Steppe 2.5 هذا باستثناء نسر السهول من التعداد العالمى التقديرى وذلك فى ربيع 2017 %

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	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**	

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	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

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- من الصعب التوقع الدقيق لمواقيت الهجرة وإن كان هناك عدد من النتائج التى يمكن استقصائها من المواسم السابقة من
- المطمئن أن هذه ألنماط تكررت فى موسمى الخريف وموسمى الربيع
- وقد توجه الى حد ما إدارة المخاطر التى تتعرض لها الطيور من جراء التنمية

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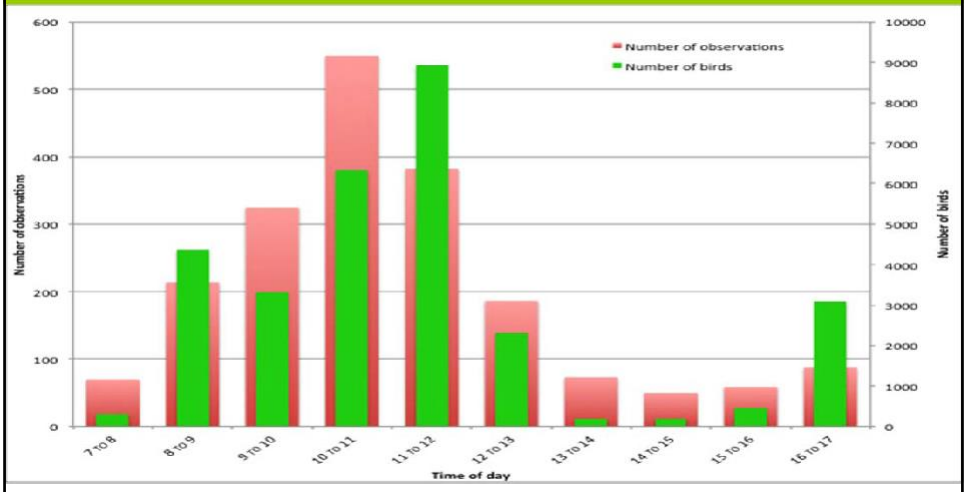
- الهجرة غير منتظمة والعدد ألكبر من الطيور يمر عبر المنطقة فى أيام قليلة بأعداد كبيرة • هناك

ذروتين يوميتين

- صباحاً)من 8 الى (10 وألخرى مساء)من 3الى 4 (في الخريف
- ذروة واحدة كبيرة (من 10 الى 12 صباحاً) في الربيع وواحدة صغيرة (من 4 الى 5 مساء)

- هذا ال يعنى عدم عبور طيور فى ألوقات ألخرى ولكن العدد الكبير قد يؤدى إلصابات كثيرة



Bird and observation numbers by time of day showing daily migration pattern •

- طيور تم رصدها فى النصف الثانى من أغسطس • 88% من 68% •
- الطيور تم رصدها حتى منتصف سبتمبر • حوالى 25% من
- االيام لم يرصد بها أى طيور
- ضح أى تأثير للرياح على الهجرة حيث أن فصل الخريف يتميز باستقرار اتجاه الرياح •

)بمكون شمالى)نفس االتجاه العام للهجرة

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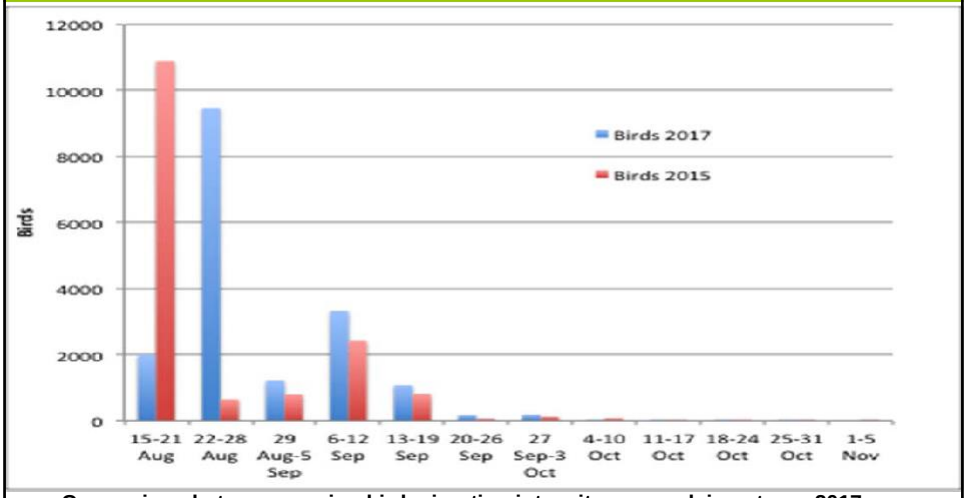

Comparison between soaring bird migration intensity per week in autumn 2017 and 2015

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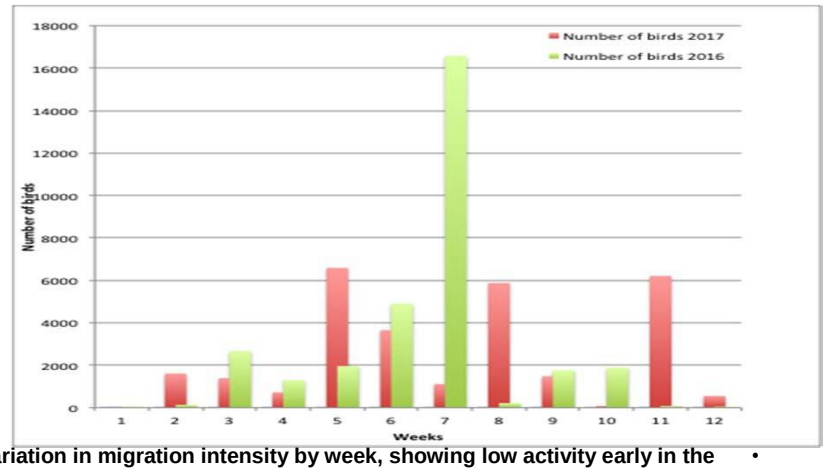
- هناك تأثير ملحوظ لاتجاه الرياح على هجرة الطيور فمثلاً الرياح ذات المكون الشرقي تمثل 18% من الوقت و50% من الطيور المرصودة. وكذا
- الرياح الجنوبية يقل معها أيضا مدى الرؤية مما يزيد من مخاطر االصطدام
- من زمن الرصد لم تمر به الطيور 40%
- يوجد أكثر من ذروة لهجرة الطيور موزعة بطريقة أكثر انتظاماً من الخريف وإن كانت تبدأ بعد شهر فبراير



Variation in migration intensity by week, showing low activity early in the season, a peak in numbers in mid April, and great variability from week to week

- تم تقييم خطر اصطدام الطيور مع التوربينات بموقع ليكيلا خلال فصلي الخريف والربيع بتطبيق نموذج مخاطر االصطدام **(Collision Risk Management – CRM)** المعتمد على Scottish Natural Heritage (SNH) 2000, 2010),
- يأخذ النموذج فى اعتباره عدد الطيور (فى االرتفاع التى تتعرض فيه للخطر)وأنواعها ومدة بقائها فى المنطقة
- تتراوح بين معدل rate avoidance behavioural يطبق النموذج اثنين من معدلات التفادى التفادى بنسبة 95%، ومعدل التفادى الأكثر واقعية بنسبة 98.%

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- اشارت النتائج إلى أنه من المتوقع أن يتراوح إجمالي حالات الوفاة المحتملة (بدون أي إجراءات للتخفيف) ما بين **54 و22 طائر** في فصل **الخريف (0,64 الى 0,25) للتوربينة الواحدة**، وما بين **46و طائر** في فصل **الربيع (1,4 الى 0,5 للتوربينة الواحدة 114**)
- بناء على هذه المحاكاة تمثل ثلاثة أنواع نسبة 96% من الخسائر المقدرة **(Stork) White - (Black Kite - Steppe Buzzard**
- بدون اجراءت تخفيف من مشروع رياح (population) التأثيرات المحتملة على تعداد الطيور واحد تعتبر مقبولة
- ما عدا حالة نسر السهول المهدد وأعداده مثلت نسبة كبيرة من التعداد العالمى فى ربيع 2017
- تعتبر التأثيرات التراكمية لمجمع المحطات على تعداد الطيور ذات أهمية وتم دراستها فى إطار الدراسة الستراتيجية ... لذا وجب اتخاذ اجراءات جادة للتخفيف

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Study	This study 95% avoidance	This study 98% avoidance	Lekela***	KFW 200 MW site**	ItalGen* site
Location	R. Gharib	R. Gharib	R. Gharib	G. Zeit	G. Zeit
Date	2017	2017	2016	2015	2013
Total casualties	114	46	22	122	104
Number of turbines	84	84	17	100	100
Casualties / turbine	1.4	0.5	1.2	1.2	1

Comparison of different collision risk predictions made for the spring season

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- تم الأخذ في الاعتبار عدد من إجراءات التخفيف أثناء **التصميم**:
  - عدم استخدام الأبراج ذات الهيكل الشبكي
  - توفير المسافة الكافية بين توربينات الرياح
  - طلاء شفرات المراوح بألوان تزيد من إمكانية رؤيتها
  - الحد من ارتفاع التوربينات بحيث لا يزيد عن 120 متر
  - تجنب إضاءة توربينات الرياح
  - الحد من مخاطر خطوط الطاقة الكهربائية باستخدام كابلات أرضية متى أمكن

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- ليس من المتوقع أن تتأثر الطيور المهاجرة أثناء **مرحلة الإنشاء**،
- إجراءات التخفيف المقترحة خلال **مرحلة التشغيل تتضمن**:
  - الاستمرار في رصد هجرة الطيور قبل الانشاء على الأقل خلال فترات ذروة الهجرة فى فصلي الربيع والخريف
  - الحفاظ على المنطقة غير جذابة للطيور (مثل حظر أي نوع من الزراعة)
  - الرصد بعد الانشاء، لاسيما خلال المراحل الأولي للتشغيل للتحقق من التنبؤات باستجابات الطيور

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- يشير نمط هجرة الطيور إلى أفضلية تطبيق نظام الايقاف عند الطلب
- إن كان هناك ضرورة للإيقاف في أوقات ثابتة فهي اوقات محدودة في موسم الخريف وقد ترتبط بمعايير مناخية في موسم الربيع.
- هذا مع استمرار الإيقاف عند الطلب ماعدا ذلك.

- مع الالتزام بتنفيذ متطلبات برنامج إدارة التوربينات Turbine Active Management Program (ATMP) for Wind Power Projects طبقا للنتائج والتوصيات التى سوف تنتج عن الدراسة الاستراتيجية للمجمع فيما يخص:
  - إيقاف التشغيل
  - الرصد على المدى الطويل طوال فترة المشروع – المعنية
  - خطة الاتصال والتواصل الفعال مع الأطراف –

□□□□□

- يعد المشروع من أنظف طرق إنتاج الطاقة حيث لا ينتج عن تشغيله انبعاثات أو ملوثات وبالتالى ليس له تأثيرات محتملة ذات أهمية.
- تعتبر المخاطر التى تتعرض لها الطيور وخاصة الحوامة أهم القضايا التى يجب التعامل معها
- تعتبر التأثيرات المحتملة لمشروع ليكيلا على الطيور المهاجرة قليلة أثناء مرحلة التشغيل. وخاصة بعد تطبيق إجراءات الخفيف
- سوف يتم الالتزام بنظم الرصد و الادارة التى يتم التوافق عليها بناء على نتائج الدراسة الاستراتيجية.