200 MW Photovoltaic Power Project
Kom Ombo – Aswan
Arab Republic of Egypt

Environmental and Social Impact Assessment (ESIA)

Volume 2 – Main text

Prepared for:

March 2020

DOCUMENT INFORMATION

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5CS PROJECT MANAGER	Reem Jabr
5CS PROJECT DIRECTOR	Ken Wade

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2	Social Capital
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5	Human Capital

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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
AFD	Agence Française de Développment
AFDB	African Development Bank Group
AST	Aboveground Storage Tank
CD	Contamination Degree
CF	contamination Factor
CIA	Cumulative Impact Assessment
CSP	Concentrated Solar Power
EBRD	European Bank for Reconstruction and Development
EDG	Environmental and Development Group
EEAA	Egyptian Environmental Affairs Agency
EETC	Egyptian Electricity Transmission Company
EIA	Environmental Impact Assessment
EP	Equator Principles
EPC	Engineering Procurement and Construction
EPAP	Equator Principles Action Plan
ER	Ecological Risk
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FGD	Focus Group Discussions
HR	Human Resource
IAQM	Institute of Air Quality Management
ILO	International Labour Organization
ISES to 2035	Integrated Sustainable Energy Strategy to 2035
KII	key Informant Interviews
NEAP	National Environmental Action Plan
NOMAC	The First National Operation and Maintenance Company
NREA	New and Renewable Energy Authority
OEMP	Operational Environmental Management Plan
OESMS	Operational Environmental & Social Management System
OHS	Occupational Health and Safety
OHTL	Overhead Transmission Lines
O&M	Operation and Maintenance
PEA	Preliminary Environmental Assessment
PERI	Potential Ecological Risk Index
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PR	Performance Requirement
PS	Performance Standard

ABBREVIATION	MEANING
PV	Photovoltaic
STP	Sewage Treatment Plant
TBTs	Tool Box Talks
TPH	Total Petroleum Hydrocarbon
VECs	Valued Environmental and Social Components
WDPA	World Database on Protected Areas
WMRA	Waste Management Regulatory Authority
5 Capitals	5 Capitals Environmental & Management Consultancy

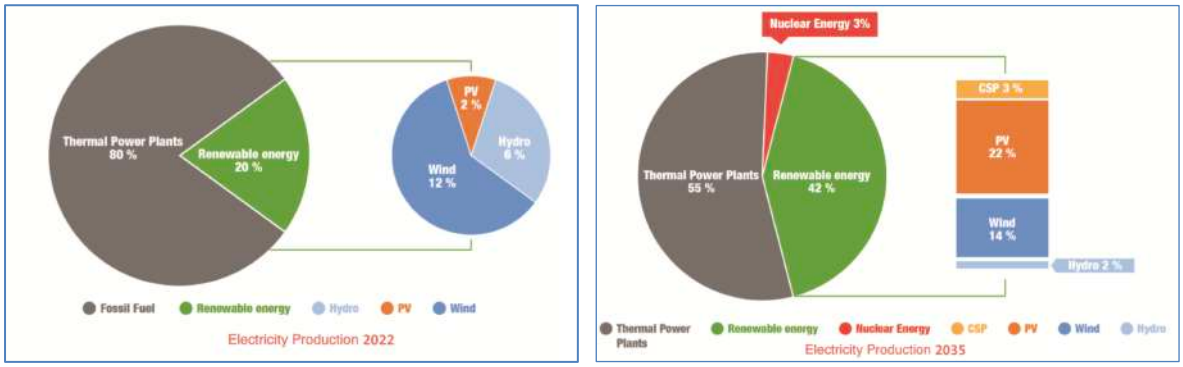
1 INTRODUCTION

1.1 Project Background

Egypt's Energy Vision is detailed in the Integrated Sustainable Energy Strategy to 2035 (ISES to 2035), released by the Ministry of Electricity and Renewable Energy in 2015. According to the ISES to 2035, the Government of Egypt plans to increase renewable energy generation capacity in the country to 20% of the total energy mix by 2022 and 42% by 2035 (International Renewable Energy Agency, 2018). The strategy envisages a total share of 16% for coal, 3.3% for nuclear energy and 42% for renewable energy in the installed capacity mix by 2035 (International Renewable Energy Agency, 2018).

As part of the Egyptian Government's strategy to generate 2.2% solar power by the year 2022 and 22% by 2035, the New and Renewable Energy Authority (NREA) with support from Agence Française de Développment (AFD) has launched the development of a 200MW Photovoltaic Solar Power Project at Kom Ombo town in the Aswan Governorate of the Arab Republic of Egypt.

Figure 1-1 Renewable Energy Targets for 2022 and 2035 (NREA, 2020)



Source: New and Renewable Energy Authority, 2020

ACWA Power has been awarded the contract to develop the Kom Ombo 200MW PV project (herein referred to as "the Project"). The Project award includes the design, engineering, permitting, procurement, construction, commissioning, performance testing, operation and maintenance of the plant. This solar PV Power Plant will be using bi-facial PV module technology and is expected to operate for 25 years according to the Power Purchase Agreement (PPA).

ACWA Power has appointed 5 Capitals Environmental & Management Consultancy (5 Capitals) to prepare this Environmental & Social Impact Assessment (ESIA) for the Project. The ESIA has been informed by the Preliminary Environmental Assessment (PEA) Report, which is also referred to as the Environmental Scoping Study (Ref **Appendix A**), prepared by 5 Capitals

and has been prepared in accordance with Egyptian environmental regulations and the expected environmental and social requirements of the prospective Lenders.

In order to ensure that the project meets the Egyptian Environmental Affairs Agency (EEAA) requirements and is submitted by a registered Egyptian consultancy, 5 Capitals has appointed Environment & Development Group (EDG), who will be responsible for elements of the assessment process, including baseline studies submission and liaison with EEAA and the necessary consultations.

ACWA Power is seeking project finance from International lenders such as EBRD and AfDB, who have their own defined Environmental and Social Policies & standards/requirements) and/or banks with investment policies that ultimately align with Equator Principles requirements or the IFC Performance Standards. As such, this ESIA has been prepared in accordance with the expected environmental and social requirements of the prospective international lenders.

It should however be noted that for the purpose of this document the term ESIA is considered to be inclusive of the Environmental Impact Assessment (EIA) requirements of EEAA as well as the Environmental & Social Impact Assessment requirements of the lenders. As such, references to the impact assessment of environmental and social parameters are termed as ESIA, unless there is specific reference to the EIA requirements of EEAA.

1.2 Key Project Information

Table 1-1 Key Project Information

Project Title	Kom Ombo 200 MW Photovoltaic (PV) Power Project
Project Owner	ACWA Power
Project Company	ACWA Kom Ombo for Energy
EPC Contractor	Mahindra Susten
Environmental Consultants	5 Capitals Environmental and Management Consulting (5 Capitals) (Lead Consultants)
	Environmental and Development Group (EDG) (Local Consultants)
Point of Contact	Ken Wade (Director)

1.3 Objectives of the ESIA

The main objectives of this ESIA in relation to the Project are as follows:

- Assessment of baseline conditions (existing conditions) prior to the development of the project through review of available data and conducting surveys;
- Assessment of the project's environmental and social impacts for the construction and operational phases;

- Review of compliance obligations, including applicable Egyptian regulations and international regulations and standards as well as international lender requirements.
- To engage with key stakeholders and project affected people to disclose Project information, study outcomes, gain lay knowledge about the local environmental and social context and seek feedback on project;
- Determination of applicable mitigation and management measures to be implemented in order to avoid or minimise potential impacts; and
- Consideration of alternatives that can be used for the project leading to greater social and environmental gains; and
- Prepare a framework from which the construction phase and operational phase respective management systems and plans can be developed and implemented.

1.4 Structure of the ESIA

In order to comply with the requirements for environmental and social assessment established by international good practice, this report is presented in the following format developed by 5 Capitals:

- Volume 1: Non-Technical Summary
- Volume 2: Main Text, Tables and Figures
- Volume 3: Environmental Management and Monitoring Plan
- Volume 4: Appendices

Volume 1 provides a Non-Technical Summary of the ESIA, including the main outcomes, and conclusions.

Volume 2 comprises the main text of the ESIA and full impact assessment, with mitigation, management and monitoring measures identified. Volume 2 aligns with the following chapter structure:

1. Introduction
    - Project Background
    - Key Project Information
    - ESIA Objectives
    - ESIA Structure
2. Project Information
    - Project Rationale
    - Project Location
    - Land Use and Site Conditions
    - Project Description

- Project Construction
- Decommissioning of the Project
- Project Alternatives

3. Regulatory Framework
    - National Regulation
    - Lender Requirements
4. Approach to ESIA
    - ESIA Team
    - ESIA Methodology
5. Air Quality (same structure for environmental aspects 6 to 14)
    - Standards and Regulatory Requirement
    - Baseline Conditions
    - Receptors
    - Potential Impacts, Mitigation, Management Measures & Residual Impacts
        - Construction and Operational Phases
    - Monitoring
6. Noise and Vibration
7. Soil, Geology and Groundwater
8. Solid Waste & Wastewater Management
9. Terrestrial Ecology
10. Cultural Heritage
11. Landscape and Visual Amenity
12. Community Health, Safety & Security
13. Socio-Economics
14. Labour & Working Conditions
15. Cumulative Impacts

References

Volume 3 provides the Environmental Management and Monitoring Plan for effective implementation of the mitigation and management measures outlined in Volume 2 following impact assessment. The Volume 3 will provide a framework for the development of the Operational Environmental Management Plan (OEMP) or Operational Environmental & Social Management System (OESMS) to be developed and implemented at a later stage. The intention is for Volume 3 to be used by the O&M Company to develop the project specific environmental management plans, based on the specific findings and recommendations of the ESIA. The OESMS will include responsibilities and procedures to ensure a systematic preventative to environmental and social management. It also will establish monitoring requirements to ensure adequate performance.

Volume 4 comprises Appendices, which are as follows:

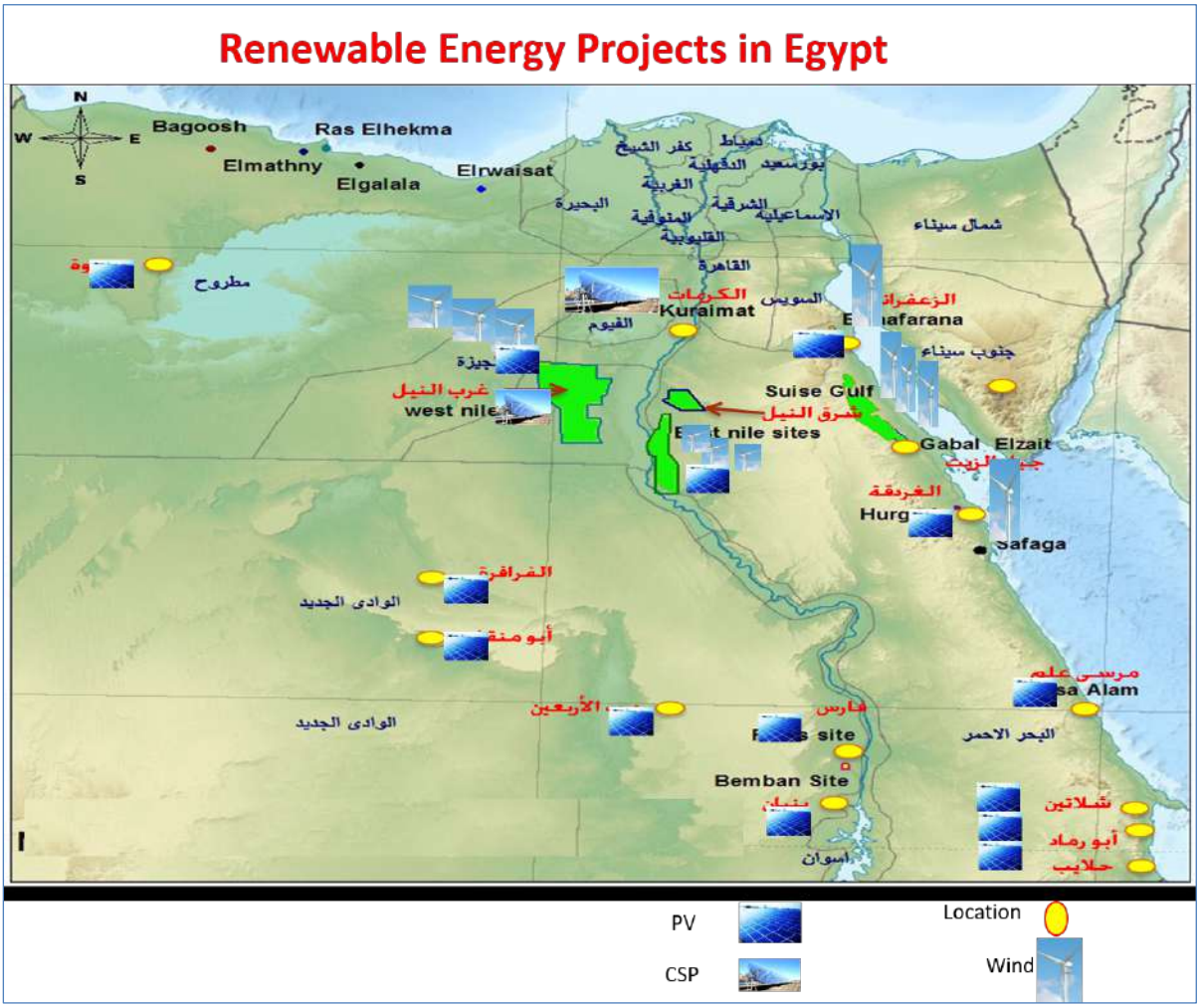
- Appendix A – Environmental & Social Scoping Report
- Appendix B – Authorisation Letter from NREA
- Appendix C – EEAA Letter on Project Category
- Appendix D – Baseline Survey Reports
- Appendix E – Invitation Letters for Public Disclosure Meeting
- Appendix F – Calibration Certificates
- Appendix G – Soil Laboratory Analysis (Pending full set of results from Laboratory in Egypt)

2 PROJECT INFORMATION

2.1 Project Rationale

The Project comes as part of implementing Egypt's Integrated Sustainable Energy Strategy to 2035 (ISES to 2035), released by the Ministry of Electricity and Renewable Energy in 2015 to develop the energy sector in Egypt. One of the main outcomes of the strategy was the need to diversify the energy resources and increase the share of renewable by 20% in 2022 and 42% in 2035 with wind providing 14%, hydro power 2%, Concentrated Solar Power (CSP) 3% and Photovoltaic (PV) 22%. Part of this share will be achieved through the implementation of the Kom Ombo 200 MW PV Project. Figure below shows the locations and type of renewable energy projects planned in Egypt as published by NREA.

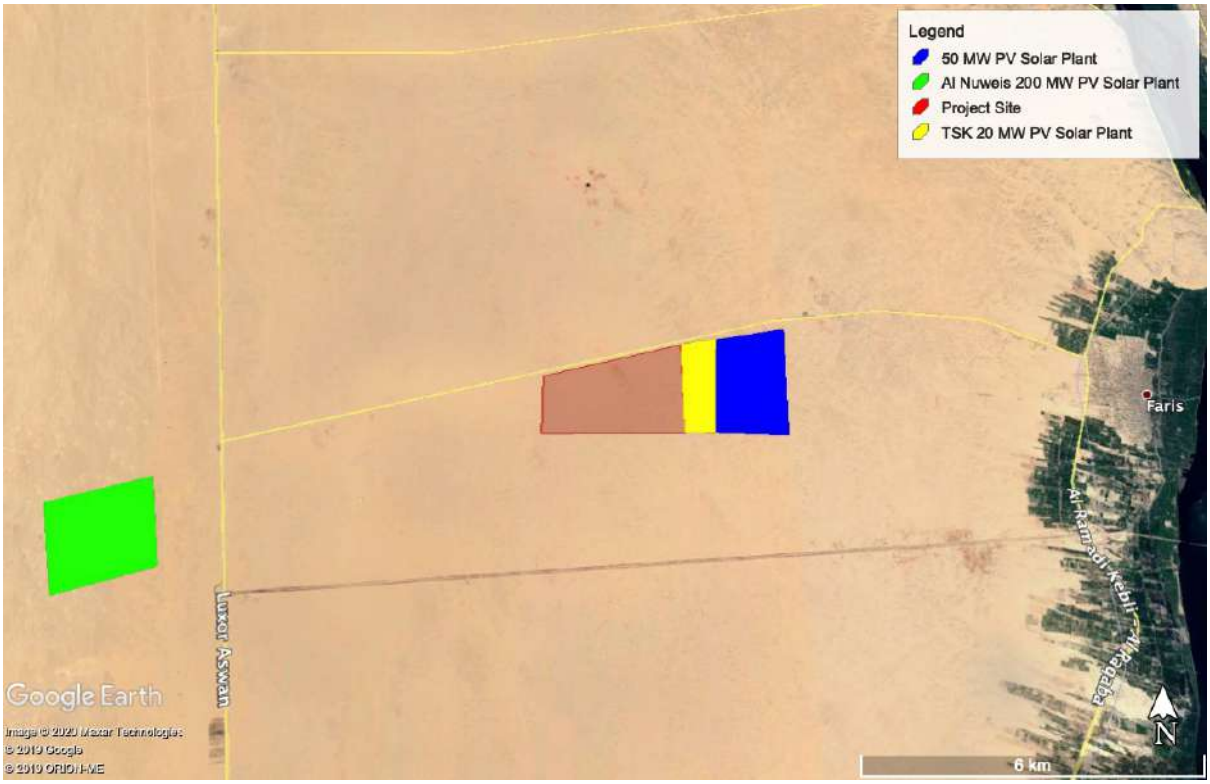
Figure 2-1 Renewable Projects in Egypt (New and Renewable Energy Authority, 2020)



The type of renewable energy projects planned in Kom Ombo area (referred to as Faris in the Figure above) are mainly PV Solar Power Plants. A list of other PV projects to be developed in Kom Ombo as published by NREA and other sources include (shown in figure below):

- 26 MW PV Solar Plant financed by ADF and owned by TSK and NREA, currently under construction. This plant is located adjacent to the kom Ombo 200 MW Project site from the east.
- 50 MW PV Solar Plant in cooperation with the Arab Fund for Development. This project is not developed yet and will be located adjacent to the TSK 26 MW PV Solar Plant from the east.
- 200 MW PV Solar Plant to be developed by Al-Newais Group and assigned by Presidential Decree No. 412 of 2016. This PV plant is located approximately 8 km west of the 200 MW Kom Ombo Project site.

Figure 2-2 Planned PV Solar Power Plants in Kom Ombo



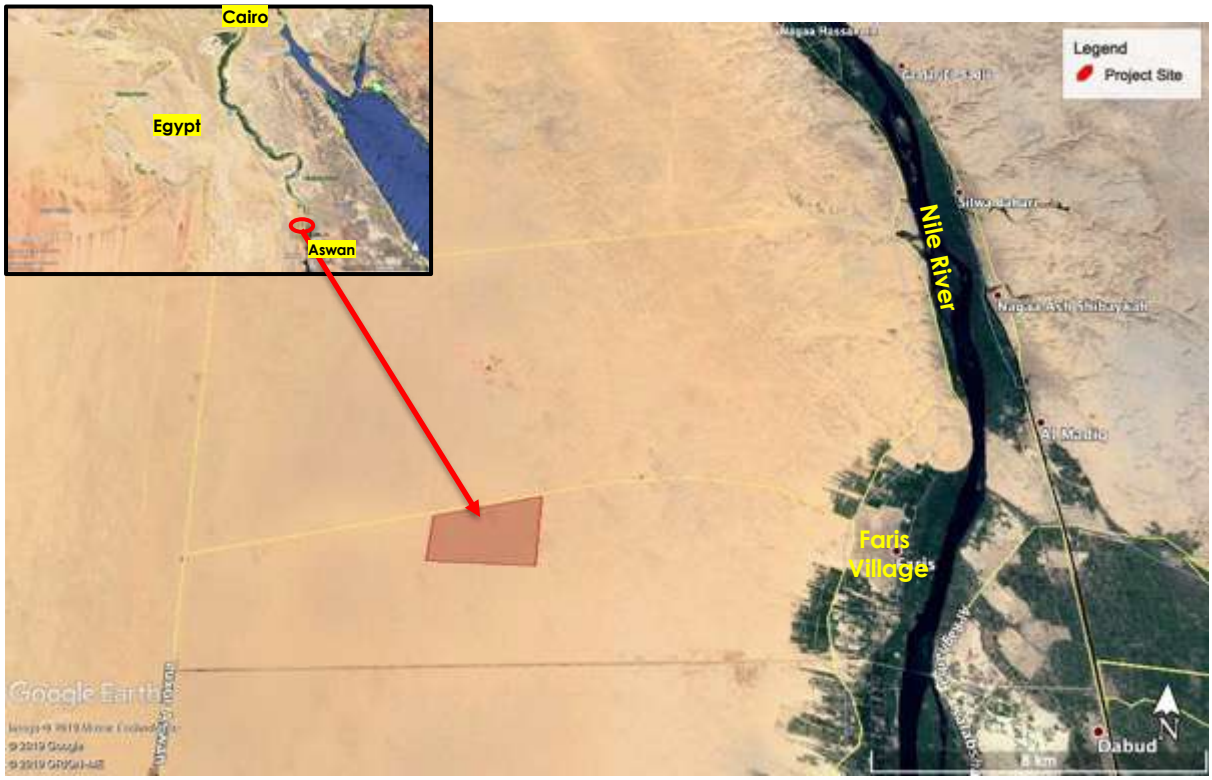
Source: Google Earth Pro, 2019

2.2 Project Location

The site is administratively within the Kom Ombo Administrative Center (*Markaz* Kom Ombo) of the Governorate of Aswan in Upper Egypt; located in a desert area.

The total area of the project site is approximately 5km^2. The proposed site is located over 600km south of Egypt's capital Cairo, approximately 60km north of Aswan city and 10.8km east of the river Nile. The closest populated village to the Project site is Faris village located approximately 8.8km east of the Project site respectively. The co-ordinates of the Project site are presented in the table below. Approximately 110m to the eastern boundary of the Project site are four (4) rows of 220kV Overhead Transmission Lines (OHTL).

Figure 2-3 Project Location

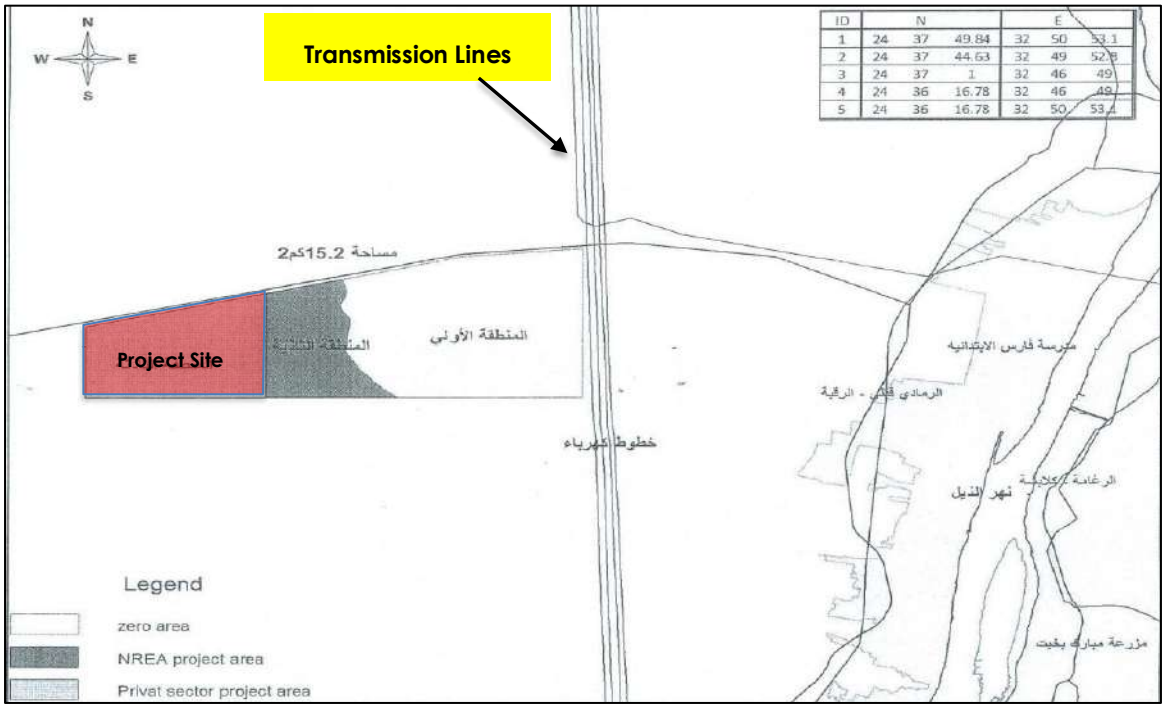


Source: Google Earth Pro, 2019

Table 2-1 Project Coordinates

	WGS 84	
	Degrees Minutes & Seconds (DMS)	
	Northing	**Easting**
1	24°37'25.06"	32°48'33.19"
2	24°36'17.43"	32°48'33.29"
3	24°36'17.42"	32°46'49.69"
4	24°37'0.50"	32°46'49.69"

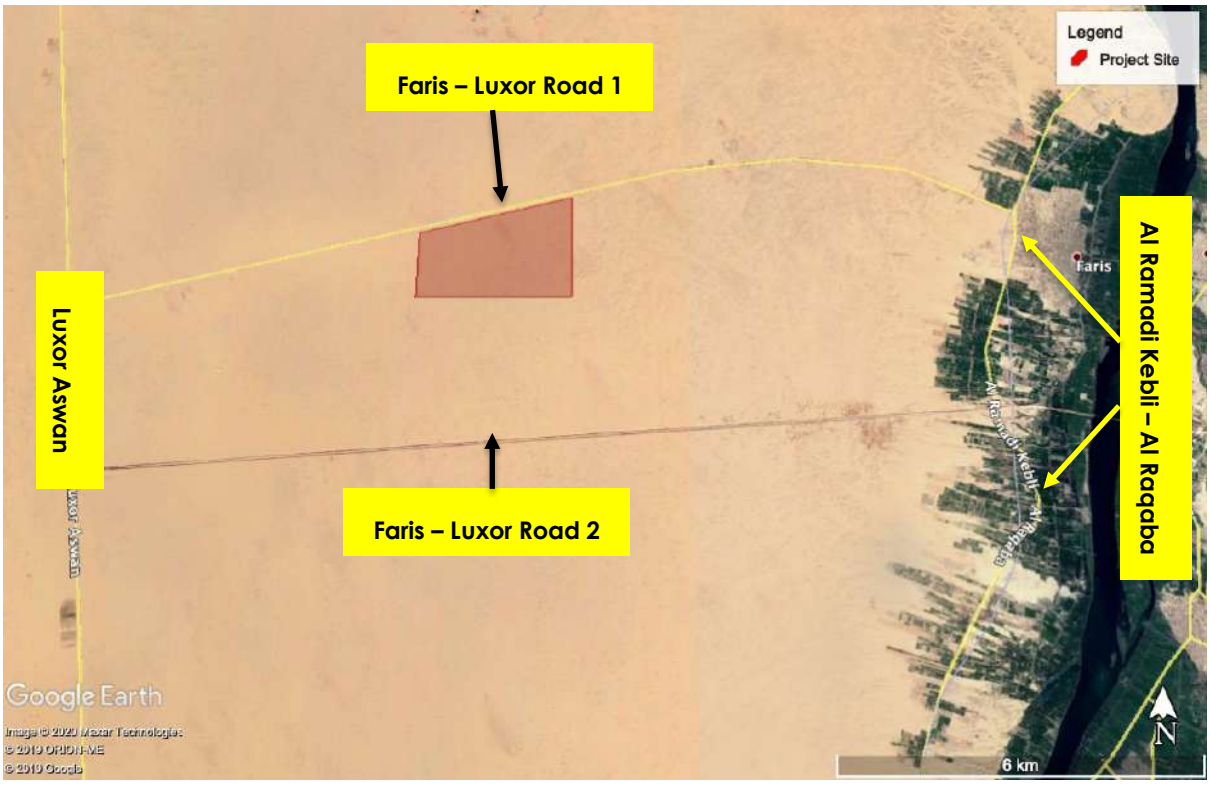
Figure 2-4 Location of Overhead Transmission Lines (ref. in red lines)



ID	N			E		
1	24	37	49.84	32	50	53.1
2	24	37	44.63	32	49	52.8
3	24	37	1	32	46	49
4	24	36	16.78	32	46	49
5	24	36	16.78	32	50	53.4

Directly adjacent to the northern boundary is a 2-way single carriageway road and approximately 2.7km to the southern boundary of the Project site is a 2-way dual carriageway road. Both of which runs perpendicular to the Al Ramadi Kebii – Al Raqaba road and the Luxor-Aswan road and connects the village of Faris to the Luxor-Aswan road. For ease of description, the roads to the north and south of the Project boundary will be referred to as Faris – Luxor Aswan road 1 and Faris – Luxor Aswan road 2 respectively as shown in Figure below.

Figure 2-5 Road Infrastructure at Project Site



Source: Google Earth Pro, 2019

2.3 Land Use and Site Condition

2.3.1 Land Ownership

The land has been assigned to NREA by Presidential Decree No. 116 of 2016. The decree reallocated government owned land including Kom Ombo Project site (referred to as Faris land in the Decree), as specified by the maps and coordinates provided in the decree to NREA for the development of wind and solar power projects including PV.

Based on formal consultations conducted with the locals in Faris Village on 17th and 18th December 2019, it is understood the land is not owned or used by any of the locals.

In terms of Kom Ombo Project site, NREA will grant ACWA Power the use of the land via the Usufruct Agreement. This agreement allows ACWA Power to build, own, operate and maintain the Project for a limited time period. With regards to this Project, the Usufruct Agreement will be valid for 25 years of the Project's operation. The Usufruct Agreement is expected to be finalised and signed in the first quarter of 2020. Currently, NREA issued an authorisation Letter to ACWA Power to grant access to the site until the Usufruct Agreement is complete. Copy of Letter is attached in **Appendix B**.

2.3.2 Land Use and Site Conditions

Project Site

The project site is located in a climatically hyper-arid, mostly barren area with extremely low primary productivity. The project site is currently undeveloped with minimal vegetation cover which includes sparse and scattered shrubs in low-lying areas. The area has a rolling topography with an overall gentle slope towards the east and is covered with coarse sand and patches of gravel. No signs of surface drainage channels were observed anywhere within the site or its surroundings. Anima life is expected to be very limited throughout the site and the surrounding area. Nonetheless, signs of wildlife were observed in the project site. Animal tracks and burrows of rodents (e.g. jerboas and gerbils), as well as insects (e.g. tenebrionid beetles) and fringe-toad lizards were spotted in vegetation patches. Some reptiles may also be present, but are currently in hibernation. Plate 2-2 presents a compilation of photographs of the Project site.

Plate 2-1 Project Site Conditions – Compilation of Photographs

SITE PHOTOGRAPHS	
Project Site	
Minimal Vegetation on Site	Animal burrows observed on site
	
Site Topography	

SITE PHOTOGRAPHS	
	

Site Land Use

A site visit was conducted on the 17th and 18th of December 2019 to assess the site conditions and surrounding areas. The Project site is undeveloped (greenfield) and has no signs of past or on-going apparent uses. Further detailed visits have been conducted in February 2020 for baseline studies. Based on the site visits and the consultations undertaken, it is understood that there are/have been no current or previous uses of the land.

Surrounding Areas

Land use patterns at the study area have been observed from the review of satellite imagery, observations made on-site and as assessed based on a number drive through transects. These transects followed all roads in the area, including two main roads within Faris village. Geotagged, photographic records of areas on both sides of the road were taken every 50 meters using GPS cameras mounted on the vehicle. The geotagged photographs were subsequently reviewed and compared with available satellite imageries to estimate the extent of different land uses in the area.

Table 2.2 and Figure 2.6 present a description of the surrounding areas and land-uses within 5 km radius from Project boundaries. Also, a compilation of photographs of the surrounding land use are presented in Plate 2-2. The closest receptor/user identified during the site visit conducted on 18th December 2019, are Faris Contractors Union situated approximately 100 m from the north eastern corner of the Project Site. The union is a group of local contractors who are currently providing different services to the neighbouring PV project which is currently under construction, owned by NREA and TSK. The union currently manages the construction waste generated from the adjacent TSK PV project by which they segregate, compact and

give the waste to different recycling companies. The presence of the Faris Contractors Union is temporary and most likely they will relocate based on availability of work.

The project site is bordered by a TSK PV Solar Power Project to the east, which is currently under construction. Located across the road to the north east approximately 150 m from the Project site are a group of local contractors situated in caravans/ porta cabins. Similar to the Faris Union Contractors, they are not considered permanent users and most likely will move with the availability of work.

The only residential area located within 5km radius is the New Faris Village located approximately 3.2km north east of the Project site. The housing project compromises of 100 houses that was developed by the Ministry of Housing and Governorate of Aswan for the unemployed youth from Faris Village. Following the 2011 popular up-rise and the subsequent political turmoil, the project was completely abandoned by the government. The houses, which were actually turned over to the villagers who paid a small payment, were never occupied but still stand.

Approximately 4.7km north of the Project is an accommodation camp that built by an EPC Contractor for one of the Projects in Kom Ombo. A private farm and an oil rig are located approximately 5km and 6km west and south west of the Project site, respectively.

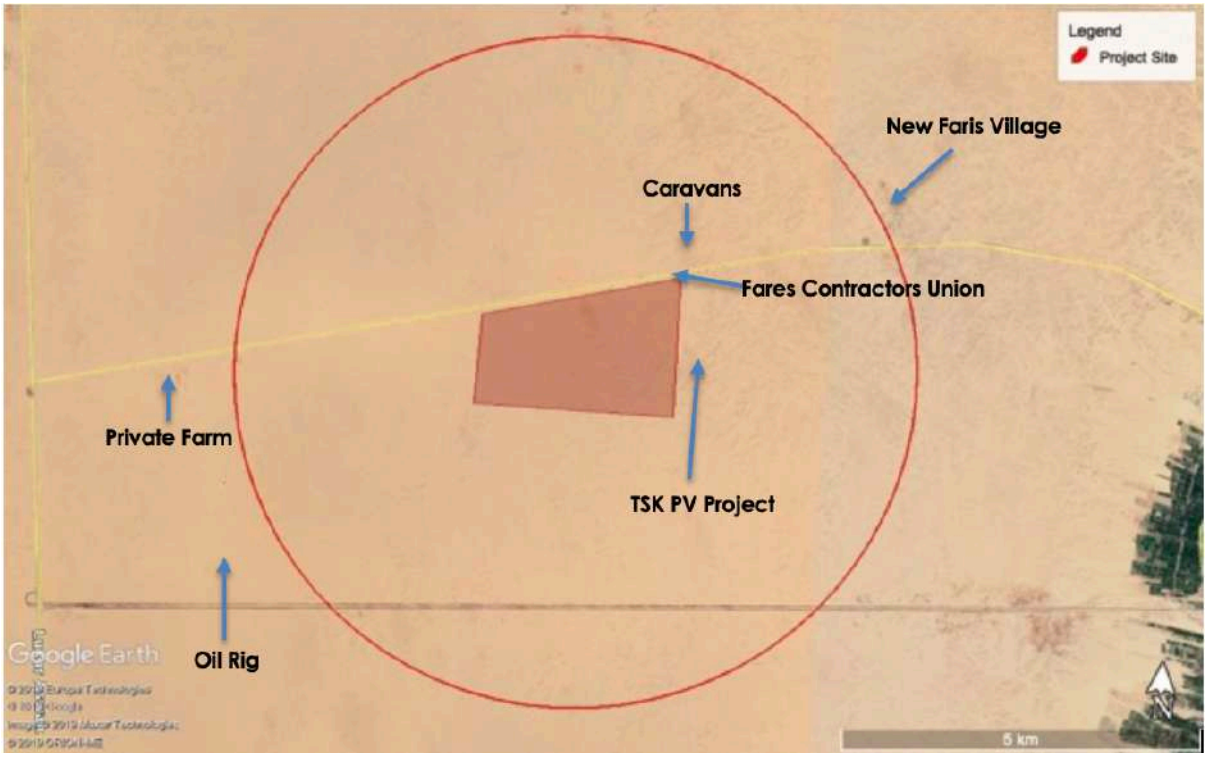
The farm, which has now about 20 hectares under cultivation, appears to have been much larger in the past as several plots are left fallow. Water for irrigating the small olive trees at the farm comes from one or more groundwater wells. At the present time, however, the farm does not appear to be very productive. According to Faris villagers, the establishment of the farm by an influential outsider, is intended as a means for staking a claim to a large piece of land as land value is expected to increase considerably as the area becomes, or developed.

The Faris village and the Nile River are located approximately 8.8km and 10.5km east of the Project site respectively. Like most of the villages in Upper Egypt, Faris is built just above the western flood plain of the Nile River. The fertile land of the flood plain fronting the village, which is only 0.5 to 0.75 km in width and less than 10 meters above the level the Nile's water, is densely cultivated. Desert land west of the flood plain, both north and south of Faris, has been reclaimed for agriculture by local villagers using Nile water or ground water pumped to the higher desert areas above the flood plain. The cost of pumping ground, or Nile water seems to be the limiting factor for cultivating more of the uninhabited desert land to the west of Faris.

Table 2-2 Surrounding Land Use

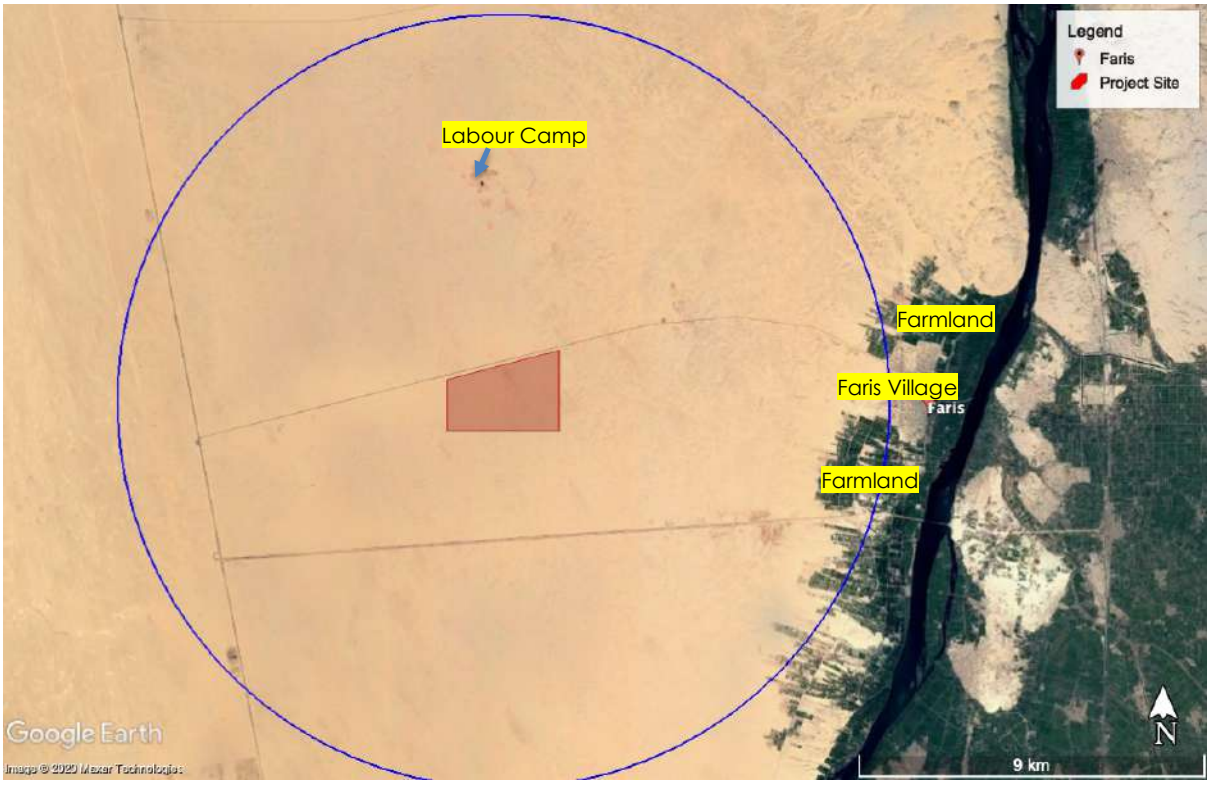
SURROUNDING AREA/ USERS	DESCRIPTION	LAND USE
Faris Contractor Union (Plate 2-2/ A)	A structure (with associated mobile caravans – referenced below) used by a group of local contractors who are currently providing different services to the neighbouring PV project. Located approximately 100m from the north eastern corner of the Project Site and within the road 50m setback.	Commercial
TSK PV Project (Plate 2-2/ B)	A PV project under construction owned by NREA and TSK located adjacent to Project site from the East.	Industrial
Caravans (local contractors)	Caravans for local contractors looking to work in PV projects located across the road to the north east approximately 150 m from the Project site.	Commercial
New Faris Village - Residential Development (Abandoned) (Plate 2-2/ D)	An abandoned residential development of 100 houses developed by the Ministry of Housing and Governorate of Aswan for unemployed youth in 2005. Development located approximately 3.2 km north east of Project site.	Residential (Abandoned)
Accommodation Camp	A worker accommodation camp located approximately 4.7km north of the Project boundary.	Residential
Private Farm (Plate 2-2/ C)	Private farm located approximately 5 km west of the Project site.	Agricultural
Oil Production Facility (Plate 2-2/ E)	Approximately 6 km southwest of the project site.	Industrial
Agricultural Farmlands	Approximately 7.8 and 8.2km south east and north east of the Project boundary.	Agricultural
Faris Village	Approximately 8.8km east of the Project boundary	Residential

Figure 2-6 Surrounding Land Use (5 km Radius)



Source: Google Earth Pro, 2019

Figure 2-7 Surrounding Land Use (10 km Radius)



Source: Google Earth Pro, 2019

Plate 2-2 Surrounding Land Use – Compilation of Photographs

PHOTOGRAPHS	
A- Faris Contractor Union (Waste segregation activities carried out by Contractors for adjacent TSK PV construction site)	
	
B - TSK PV Project	C- Private Farm
	
D- New Faris Village (Housing Development)	E- Oil Production Facility (Oil Rig)
	

Historical Changes in Land Use

Up to the early 1980s, land cultivated by the Faris village farmers was restricted to the Nile's floodplain and was entirely dependent on water pumped from the Nile. Area to the west, outside of the floodplain was an uninhabited, barren desert. The last two decades of the last

century witnessed a rapid expansion of the Faris village itself over the desert land, and the beginning of agriculture activities above the river's floodplain using ground water pumped from the relatively shallow aquifer. Land reclamation activities continued to expand, particularly after 2011. The desert land area reclaimed for agriculture is now considerably larger than the original agricultural land in the Nile's floodplain. The series of satellite images below illustrate historical changes in cultivated land area.

Figure 2-8 Historical changes in land use in the Study Area

All these land reclamation activities, as well as the expansion of the village itself, were based on informal ownership claims by individuals and families from the Faris area and involved informal occupation of public land. In the last two years, however, the government started to implement a nationwide scheme to identify, valuate and formalize ownership of informally/illegally occupied/utilized public land. According to that scheme, public land tenure can be sold to its informal occupier for a price to be determined by relevant government authority [1] (usually the General Authority for Reconstruction Projects and Agricultural Development), taking into account the location and potential uses. For the Faris area, this land ownership formalization process is still ongoing.

[1] The Ministry of Irrigation and Water Resources is responsible for granting permits to drill wells to obtain groundwater for the agricultural project.

2.4 Project Description

2.4.1 PV Components

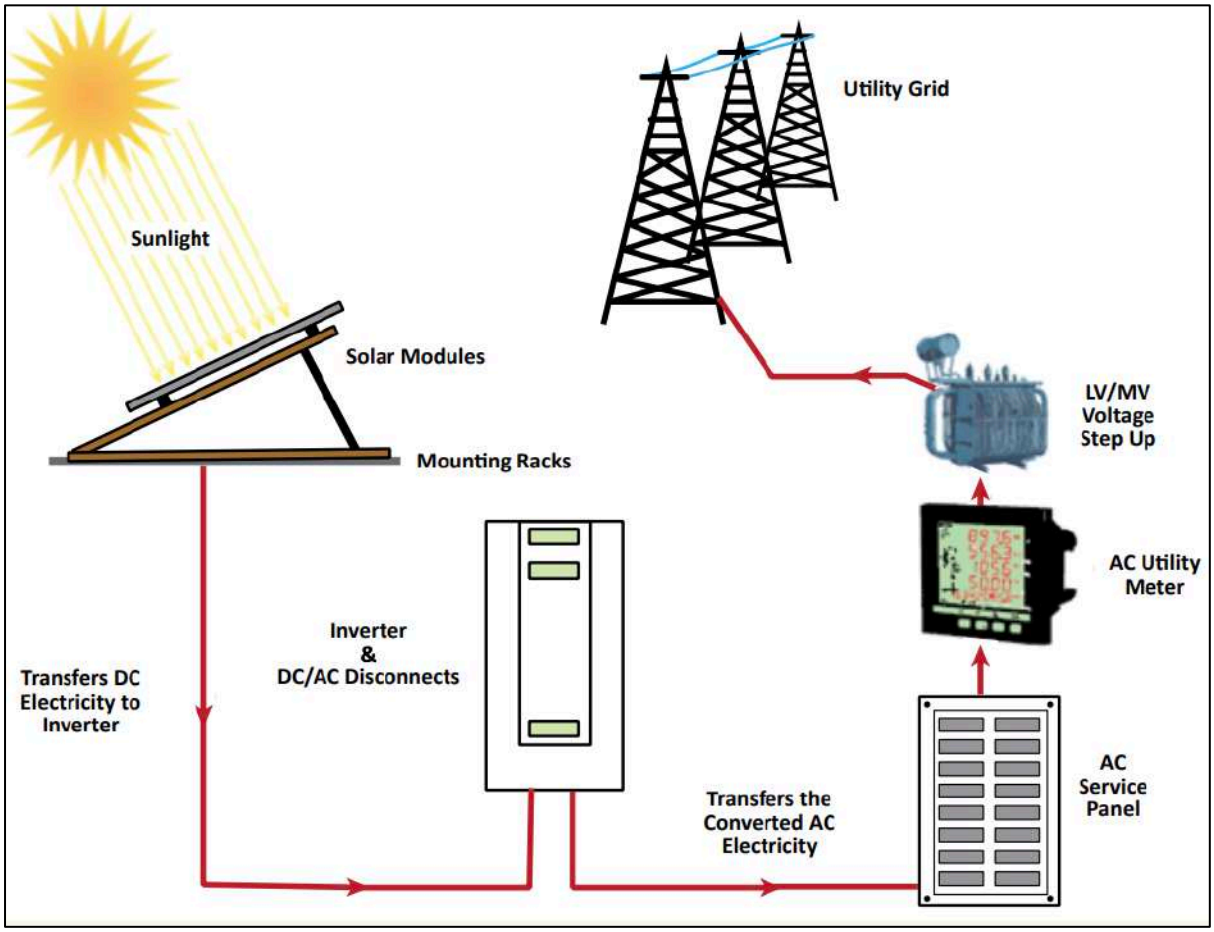
The project will comprise 1 x 200MW PV Plant using bi-facial technology. The PV cells within modules will be installed on fixed or tracking ground mounted racks arranged to ensure the most efficient alignment for the capture of solar radiation.

Photovoltaic Power Plants use photovoltaic cells to generate electricity upon exposure to sunlight. This power generation technology converts solar radiation into direct current electricity using semiconductor materials in the form of a panel that exhibits photovoltaic effects. A typical PV Plant mainly comprises of a solar field which consists of a large group of semiconductor technology-based silicon solar cells arranged in what is known as solar PV Panels or PV Modules. The solar panels convert sunrays (photons) to electrons and the electron flow generates Direct Current electricity (DC) which gets connected and channelled into an electric device 'inverter' to convert the DC into Alternating Current (AC).

The main components of a typical PV Plant include the following (shown in Figure below) (International Finance Corporation, 2015):

- Solar PV modules: These convert solar radiation directly into electricity through the photovoltaic effect in a silent and clean process that requires no moving parts. The PV effect is a semiconductor effect whereby solar radiation falling onto the semiconductor PV cells generates electron movement. The output from a solar PV cell is DC electricity. A PV power plant contains many cells connected together in modules and many modules connected together in strings to produce the required DC power output;
- Inverters: These are required to convert the DC electricity to AC or connection to the utility grid;
- Module mounting: These allow PV modules to be securely attach to the ground at a fixed tilt angle;
- Step-up transformers: The output from the inverters generally requires a further step-up in voltage to reach the AC grid voltage level. The step-up transformer takes the output from the inverters to the required grid voltage; and
- The grid connection interface: This is where the electricity is exported into the grid network. The substation will also have the required grid interface switchgear such as circuit breakers (CBs) and disconnects for protection and isolation of the PV power plant, as well as metering equipment. The substation and metering point are often external to the PV power plant boundary and are typically located on the network operator's property.

Figure 2-9 Overview of PV Power Plant (International Finance Corporation, 2015)



2.4.2 Internal Roads

Internal roads within the Project site will be developed such that it is adequate and suitable to connect to the road network in order to facilitate transportation of equipment to and within the site.

2.4.3 Utilities

Wastewater

Besides sanitary wastewater, no specific wastewater streams will be generated from day-to-day operational activities at the PV plant. Wastewater will be generated from use of toilet facilities on-site. However, this is expected to be in relatively small quantities given that the Project requires a small number of O&M staff at any time. The wastewater will be collected in dedicated septic tanks and transported to approved and regulated wastewater treatment plants in Egypt.

Panel cleaning is to be undertaken by dry cleaning. On occasions, it may be necessary to use water for wet cleaning although this will not generate a specific wastewater stream, rather with any residual water evaporating or dripping to the soil surface.

Electrical Supply

The Project will primarily utilise an amount of its own renewable electrical generation, but will otherwise draw electricity from the grid as required when not generating (e.g. at night). The Project will include an emergency diesel generator for use during black-out situations.

2.4.4 Associated Facilities

The associated facilities for the proposed Project will include:

- Connection to external road;
- Water supply connection; and
- Electrical connection to grid.

External Roads

Entrance into the Project site is expected to be from the northern side of the Project site, Faris – Luxor Road 1 approximately 100 m (refer to Figure 2-5 above).

Water Supply

During the operation of the plant, water will be supplied to the plant via water trucks that will efficiently transport water to storage tanks within the Project boundary in order to cover the water demand of the Project. The water will be obtained from an existing portable water Aboveground Storage Tank (AST) at the Faris Village approximately 8.8km east of the Project site. At no point will the Project require the construction of a water supply pipeline for connection to the AST.

Connection to the Grid

For connection to the grid, the plant will be connected to a 220kV/MV substation which will be situated within the Project boundary. Connection to this substation will be via 220kV cables and power will be exported via the substation to the 220kV Overhead Transmission lines (refer to Figure below). There will be a corridor between the 220kV overhead transmission line gantries outside the Project boundary.

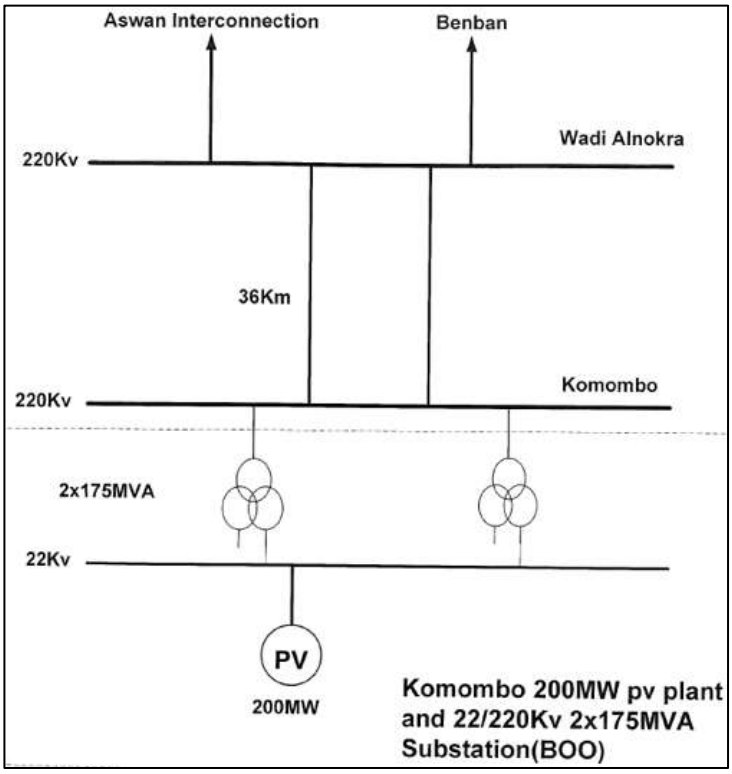
To enable connection between the PV unit and the substation and to connect this substation to the grid, the Project will require its own electrical connection facility on-site. To evacuate the power generated from the Kom Ombo PV plant into the national grid:

- ACWA Power will construct the step-up transformer from medium voltage to 220KV using med/220Kv substation.

- Egyptian Electricity Transmission (EETC) will construct the double circuit O.H.T.L (Solar Kom Ombo plant / Wadi Nokra) 220KV with a length of about 36 Km of type ACSR (2*380/50 mm2) (Note: subject to EETC final transmission line route).

Further information on the associated facilities will be provided by EETC in due course and at which time it will be determined who will be responsible for undertaking the EIA/ESIA for the associated facilities.

Figure 2-10 Single Line Diagram for the Evacuation of the Power from the 200MW PV Project



2.4.5 Project Operational Requirement

The project will be operated and maintained by The First National Operation and Maintenance Company (NOMAC). During the operational phase, routine activities will primarily include:

- Security staff operations,
- Management and Administration staff operations,
- PV Plant and SCADA operations,
- Supply of electrical energy to grid,
- Cleaning of PV panels,
- Maintenance of plant and cleaning devices.

It is noted that cleaning of the PV panels/modules is planned to be conducted automatically (I.e. brushes installed on tracks along the rows of the modules) without the use of water in order to make the cleaning process more resource efficient (i.e. avoiding water use) and economically sound. However, on some occasions, it may be necessary to utilise water to ensure effective cleaning.

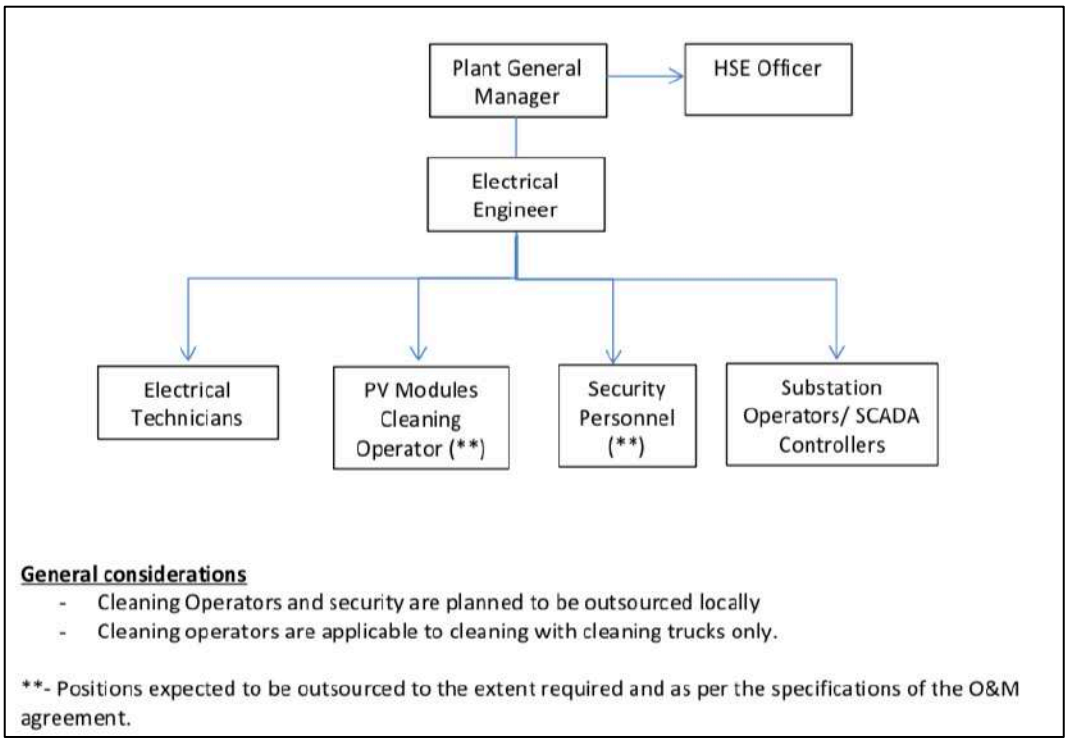
Manpower Requirements

A maximum of 10 personnel will be required for the operation of the plant on a two shift basis. The plant will operate over two 12-hour shifts each day. The Table below presents a breakdown of the manpower required and typical shift pattern. Figure below presents an organisational chart for the operation of Kom Ombo PV Plant. The organisational chart is for indicative purposes only and may be subject to change as per the O&M Contract, specific operational requirements of the site and equipment installed.

Table 2-3 Manpower Requirement and Shift Pattern (NOMAC, n.d.)

POSITION	NUMBER OF SHIFTS
Security Personnel	2 shifts of 2 operators, 12 hours per shift
Shift Technicians	One shift of 12 hours for total of 1 to 2 technicians on site 7 days a week
SCADA and Substation Operators	One shift of 1 operator, during Plant production hours, for a total of 2 shifts covering 365 days per year.
Plant Manager	During office hours
HSE Officer	During office hours (with designated first aiders and emergency response personnel on-site 24-hours.
Electric Engineer	During office hours

Figure 2-11 Organisational Chart (O&M) – Kom Ombo PV Plant (NOMAC, n.d.)



2.5 Project Construction

The Project will be constructed by Mahindra Susten under an EPC Contract with the Project Company. Mahindra Susten will be the EPC Contractor and will further engage numerous sub-contractors to undertake specific construction and equipment installation/commissioning activities on-site. Such sub-contractors may be locally based in Aswan/Egypt, or may need to be specialist companies from further afield. Such sub-contractors are still to be arranged by the EPC Contractor.

2.5.1 Construction Activities

Principal construction activities and associated requirements in relation to civil works are anticipated to include but not limited to;

- Site clearance, grading and fencing;
- Construction of general buildings, such as administrative and control buildings, temporary site offices, staff facilities, storage area/building, electrical building, auxiliary buildings and structures, etc.;
- Installation of drainage pipe network (f required);
- Construction and reinforcement of access roads;
- Excavations for foundation and on-site interconnections;

- Installation of distribution systems for temporary utilities such as electric power, inverters, MV switchgear, potable water, sewage disposal;
- Construction of cable trenches, preassembly area, cranes platforms etc; and
- Installation of solar PV system (PV modules).

Principal Project construction activities in relation to electrical works include installation of;

- Electrical system including lightning and overvoltage protection;
- LV power supply;
- Cabling and cable supporting systems and;
- Uninterruptable power supply as required etc.

2.5.2 Construction Requirements

Manpower requirements

The estimated number of construction workers on site during peak is expected to be between 800 - 1000 workers. However, requirements for manpower are will be finalised at a later stage once the EPC contractor has all sub-contractor agreements in place.

Temporary Laydown Areas

Temporary laydown areas will be required during the construction phase of the Project for the storage of materials by the Engineering Procurement and Construction (EPC) contractor as well as sub-contractors. The areas for the laydown areas will be within the Project site as designated, although the specific space has not yet been designated.

Worker accommodation

Requirements for worker accommodation are yet to be finalised, but will be provided on a contractor-by-contractor basis. These areas will need to be arranged by the separate contractors' companies. Where accommodation is required (i.e. not using local labour) it is expected that contractors will make private arrangements with camp providers and or other private accommodation (hotels/guesthouses etc.). It is likely that these will be situated in the local area of Aswan. For example, there is a worker accommodation camp located approximately 4.7km north of the Project site.

Wherever located, the necessary worker accommodation will need to be of a standard aligning with the IFC & EBRD Workers' Accommodation Processes and Standards.

2.5.3 Utilities & Waste

Electrical Supply & Fuel

Due to the isolated nature of the Project site, the use of temporary diesel generators will be required during construction. Although unconfirmed at this stage, it is expected that each contactor will supply its own generator(s) for power supply to their own temporary cabins and plant.

It is expected therefore that the EPC Contractor and Sub-Contractors will need to have their own diesel storage facilities on-site, which are expected to receive fuel from tanker delivery.

Water Supply

During site preparatory stage, the project will require both potable and non-potable water supplies for the construction facilities and activities. A licensed water supply company will supply the water required to cover the water demand of the Project to the site via water tanker trucks.

Wastewater

Domestic wastewater will be generated from toilets on-site, as well as any canteen/catering activities. No sewage treatment activities will be undertaken on-site. Estimated on the expected generated wastewater volumes during construction and management plan is not available at this stage, and will depend on the ultimate number of workers employed by all contactors. This will also vary across the construction phase with the level of manpower on-site.

Wastewater generated from the construction site will be collected via septic tanks removed on a regular basis by a licensed operator. The management of the septic tanks, will be compliant with local requirements and international best practise. The following measures will be carried out (Construction Method Statement, n.d.):

- Sewage will be treated at a nearby authorized municipal Sewage Treatment Plant (STP);
- Installation of an overflow alarm or implementation of an inspections procedure to ensure that septic tanks are emptied before 80% capacity is reached;
- Ensure that the underground septic tank is not leaking (e.g. incoming sewage should be measured and compared with outgoing sewage. If the figure is consistently below what is expected, the tank will be inspected for leaks);
- Chemical toiles should be regularly inspected for leaks; and
- Mobile collection tankers shall have available a metal drip tray or ground protective sheet/blanket to avoid spills occurred during sewage transfer.

2.6 Decommissioning of the Project

Given that the decommissioning phase is not expected for a minimum of 25-years from the Commercial Operation Date (based on the term of the PPA), there are no specific requirements provided for the decommissioning of the Project.

It is not considered practical at this stage to speculate on future environmental and social conditions including the sensitivity of current or future receptors at this time, or facilities that may or may not be present to handle wastes etc., or the new environmental regulations that may exist.

Therefore, all impacts relating to decommissioning stage should be planned to be approached and mitigated via a specific decommissioning plan prepared closer to the time of decommissioning as it would be able to account for changes in regulation, improvements in technology and methods of demobilization. The decommissioning plan would be developed prior to decommissioning and would be based on the projects ESMS.

In summary the Decommissioning Plan would require the following:

- Discussion with the Government Regulators commencing up to 5 years prior to the planned date to allow for detailed planning and preparation/approval of a Decommissioning assessment;
- Stakeholder Engagement Plan (subject to the prevailing Law and Regulations);
- Compliance with local Regulator standards and international requirements and industry best practices on recycling and reuse of materials and habitat restoration of Project site.

2.7 Project Alternatives

In accordance with good practice methodologies for ESIA, the evaluation of various project design and activity alternatives should be considered, in order to ensure that the objectives of the proposed project have accounted for social, environmental, economic and technological options. The following project alternatives were considered at the feasibility stage:

- No Project Alternative;
- Site Selection; and
- Technologies for Solar power technology.

2.7.1 No Project Alternative

Should the "Do Nothing" scenario be applied, then the anticipated negative impacts discussed throughout this ESIA will not occur. However, as assessed in this report, these impacts which are most likely to happen during the construction phase, are not expected to pose

significant risks and can be adequately controlled through the implementation of the mitigation measures discussed in accordance with the Framework for Environmental and Social Management (ref. Volume 3 of this ESIA).

If the project were not to go ahead, the positive impacts and benefits that will result from the operation of the plant such as development of utilities, socio-economic benefits, and the increase in renewable energy, will not occur. Such benefits of the Project will therefore not be realised:

- Cutting carbon emissions and reducing reliance on traditional non-renewable power sources;
- Creating employment and training opportunities for Egyptian nationals in the field of solar and renewable energy;
- Replacing fossil fuels and promoting alternate energy sources which is in line with ISES to 2035 and Egypt's SDG.

Therefore, the implementation of the PV Plant will have a positive impact in its contribution towards meeting the country's targets and the "No Project Scenario" is expected to hinder the Egyptian governments initiatives in achieving the above.

2.7.2 Site Selection

The Project is part of a larger NREA owned land planned for PV projects. Therefore, the proposed site is already earmarked for the development of renewable projects by the government and assigned to NREA by Presidential Decree No. 116 of 2016.

Therefore, an alternative site location has not been considered. It is only reasonable to construct the 200 MW Kom Ombo PV Solar Plant adjacent to the other planned Solar PV Plants in line with NREA masterplan and as such this will benefit from certain common infrastructure and associated facilities.

2.7.3 Solar Power Technology

During the bidding stage, ACWA Power proposed the use of the following technologies for the development of the Project:

- Bi-facial type Solar PV Panels which generates energy from both top and rear sides;
- Single axis tracker technology mounting system; and
- String or central inverters.

Based upon the chosen design it is expected that the bi-facial type solar PV panels will maximise the efficiency of power generation from the Project.

3 REGULATORY FRAMEWORK

3.1 Introduction

The following chapter presents the regulatory requirements for conducting an ESIA for the Project in accordance with Egyptian Federal, Governorate/ Local Regulations as well as International guidelines, standards and good practices.

3.2 National Regulations

3.2.1 Egyptian Environmental Law, Regulation and Standards

The regulatory body responsible for the protection and promotion of the environment and the development of environmental regulations in Egypt is the Egyptian Environmental Affairs Agency (EEAA).

Law No. 4 of 1994

The law that governs environmental protection issues and addresses pollution resulting from existing projects or establishments as well as potential pollution from new establishments and expansions of existing establishments in Egypt is the Law No. 4 of 1994 for the "Protection of the Environment" amended by Law No 9 of 2009.

This Law states that "Certain new establishments are required to conduct an Environmental Impact Assessment (EIA) prior to the start of construction works, prior to the implementation or the relevant expansion of such project or prior to a license is issued by the competent administrative authority". According to Article 1 (36), Environmental Impact Assessment is defined as "studying and analysing the environmental feasibility of proposed projects, whose construction or activities might affect the safety of the environment".

The law identifies projects that should be subjected to an Environmental Impact Assessment based upon the four (4) main principles; the type of the activity performed by the project/establishment, the extent of natural resources exploitation, the location of the project/establishment and the type of energy to be used during operation of the project.

In 2009, the Egyptian Environmental Affairs Agency published the second edition of the Guidelines of Principles and Procedures for Environmental Impact Assessment which groups projects that may be subjected to an EIA into three (3) main categories based on different levels of EIA requirements according to the severity of potential environmental impacts and location of the establishment/project and its proximity to residential settlements.

According to the list of Category A, B & C projects provided in this guideline and communications with EEAA, this 200MW PV Project is categorised as a Category "B" project

and requires the preparation of an Environmental Impact Assessment (EIA) Study. EEAA official letter on Project Category is provided in **Appendix C**.

Ambient air quality, ambient noise levels and procedures for handling hazardous waste established under the Law No. 4 of 1994 have been considered in this report as they are relevant to the Project.

Egyptian Regulation and Standards

In addition to the Law No. 4 of 1994, the following specialized laws that govern the environmental and social performance of projects in Egypt are relevant to this Project and have also been considered in the preparation of this ESIA report:

- Decree 338/1995 on promulgating the executive regulations of the law for the environment;
- Law 38/1967 on general public cleaning amended by Law 31/1976 on Municipal Waste Mana, and other local Decrees in Governorates that governs solid waste management issues;
- Law 93/1962 on Wastewater and Drainage covering the construction of sewers and sewage treatment facilities including allowable discharges from residential, commercial and industrial facilities to the sewer. Ministerial Decree 9/1988 revised the standards set out in this law;
- Law 102/1983 on Natural Protectorates;
- Agricultural Law 53/1966 on protecting wildlife specially birds useful for agriculture;
- Decree 44/2000 by the Ministry of Housing on Permissible Limits for Discharged Sewage Wastewater;
- Decree 470/1971 by Ministry of Health amended by Decree 240/1979 which set limits for air pollution loads;
- Decree No. 134/1968 on guideline for handling wastes from domestic and industrial sources, including specifications for collection, transportation, composting, incineration and land disposal;
- Law No. 117/1983 on antiquities and cultural heritage requirements, the protection and procedures to follow upon detection and fundamental ownership;
- Decree No. 673/1999 on handling and transportation of hazardous waste;
- Law 94/2003 on application of the Human Rights on Egypt;
- Law No. 137/1981 on Labour, amended by Decision 12/2003 (Unified Labour Law) Book 1, 2, 3 & 4 which includes certain stipulations and standards for the working environment and the welfare of labour including:
  - General provisions on labour and working conditions,
  - General working conditions,

- Wages;
- Contract termination;
- Leaves;
- Vocational guidance and training;
- Collective association;
- Child labour; and
- Female labour

- Resolution No.851 of 2006 on hazardous and dangerous chemical substances;
- Law no. 142/2014 and 121/2008 prohibits drivers to dump wastes or any other material including accidental releases of cargo and forbids vehicles emitting high levels of noise, heavy smoke, odours and emissions that are non-compliant with environmental requirements; and
- Law No 48 of 1982 concerning the protection of the Nile River and the water channels against pollution.

Note: The emission and discharge quality standards and criteria for air, noise, waste and wastewater, etc. are listed in the relevant sub-sections in the ESIA Report.

Other National Policies

In 2002, the EEAA published the National Environmental Action Plan (NEAP), which establishes the following strategies and programmes that should be set into action between 2002 and 2017:

- National strategy for air quality management. The plan includes programmes for promoting cleaner production techniques and energy conservation and;
- Policy for proper waste management in Egypt, which incorporates the existing national municipal solid waste program from 2000. The objective is to develop the capabilities of each governorate in solid waste management and to ensure integration across governorates.

The European Commission established Horizon 2020, which is an initiative to deal with the top sources of Mediterranean pollution by the year 2020, specifically, industrial emissions, solid waste and waste water, which are responsible for up to 80% of Mediterranean Sea pollution. Egypt has agreed to implement these initiatives.

3.2.2 International and Regional Conventions/Protocols

Egypt is party to several international and agreements and conventions concerning environmental matters, with relevant examples related to the project listed below:

Table 3-1 International Protocols and Conventions (Eeaa.gov.eg, 2020)

Name of Convention (Click for Detail)	Date of Signature	Date of Ratification	Date of Entry into Force
Climate Change			
UN Framework convention on Climate change (UNFCCC)	6/9/1992	12/5/1994	3/5/1995
Kyoto Protocol	3/15/1999	1/12/2005	4/12/2005
Vienna Convention on the protection of the ozone layer	3/22/1985	5/9/1988	
Montreal Protocol on substances that deplete the ozone layer	9/16/1987	8/2/1988	
Paris Agreement	4/22/2016		
Hazardous Substances and Wastes			
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal		1/8/1993	
Stockholm Convention on Persistent Organic Pollutants	5/17/2002	5/2/2003	
Convention On The Ban Of The Import Into Africa And The Control Of Transboundary Movement And Management Of Hazardous Wastes Within Africa (Bamako Convention)	1/30/1991	5/18/2004	
Marine Pollution			
Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (Jeddah Convention)		5/31/1990	8/20/1985
Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean	2/16/1976	8/24/1978	7/9/2004
Nature Conservation			
United Nations Convention on Biological Diversity (UNCBD)	6/9/1992	6/2/1994	
Cartagena Protocol on Bio-safety to the Convention on Biological Diversity	12/20/2000	12/23/2003	3/21/2004
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization	1/25/2012	10/28/2013	
Ramsar Convention on Conservation and Wise Use of Wetlands			9/9/1988
Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS)		4/19/2010	7/1/2010
Convention on the Conservation of Migratory Species of Wild Animals (CMS), Bonn convention			11/1/1983
Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)	8/20/1997	11/1/1999	11/1/1983

3.3 Lender Requirements

ACWA Power is seeking project finance from one or more International Financial Institutions (IFIs). Currently, this includes EBRD and AfDB who have their own internal Environmental & Social Policies, Safeguards/Performance Requirements. Other lenders may also be involved who are expected to be signatories to the Equator Principles, or will align themselves with the IFC Performance Standards, or have similar internal Environmental and Social investment policies. The lender requirements are expected to include the following:

- European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (2014) and Performance Requirements;
- The African Development Bank (AFDB) Environmental and Social Assessment Procedures (2015);
- Equator Principles III (2013);
- IFC Performance Standards (2012); and,
- IFC EHS General Guidelines (2007).

3.3.1 EBRD Performance Requirements (PRs)

EBRD has adopted an Environmental and Social Policy (2014) and a set of specific Performance Requirement (PR) covering key areas of environmental and social impacts. These reflect EBRD's commitment to promote EU environmental standards as well as the European Principles for the Environment in their investments.

EBRD's Performance Requirements are summarised in the Table below:

Table 3-2 EBRD Performance Requirements

PERFORMANCE REQUIREMENT	DETAILS
PR 1	**Assessment and Management of Environmental and Social Impacts and Issues** There is a requirement for EBRD financed projects to undertake appropriate Environmental and Social Assessment. The EBRD Environmental and Social Policy (2014) categorises projects into different categories that determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. This Project is expected to be categorised as **Category "B"**. A Project is categorised B when it could result in potential adverse future environmental and/or social impacts are typically site-specific, and/or readily identified and addressed through mitigation measures. Environmental and social appraisal requirements may vary depending on the project and will be determined by the EBRD on a case- by-case basis. **The ESIA has been prepared on the basis of undertaking a full ESIA commensurate with a Category B requirement.**
PR 2	**Labour and Working Conditions** Provides guidance on the management of labour issues and includes requirements on human resource (HR) policies and employee documentation.

Performance Requirement	Details
	In addition, this requirement ensures the working conditions in the projects that it finances comply with national labour laws and health and safety regulations and international good practice in these areas. The HR policies and procedures shall be developed to achieve the following objectives as stated in EBRD PR2: • *'Establish and maintain a sound worker-management relationship* • *Promote the fair treatment, non-discrimination and equal opportunity of workers* • *Promote compliance with any collective agreements to which the client is a party, national labour and employment laws, and the fundamental principles and key regulatory standards embodied in the ILO conventions that are central to this relationship* • *Protect and promote the health of workers, especially by promoting safe and healthy working conditions.'*
PR 3	**Resource Efficiency and Pollution Prevention and Control** Projects should implement best available techniques and Good International Practice (GIP) to optimise resource efficiency and pollution prevention and control. This requirement outlines a project-level approach to identifying opportunities for energy and resource efficiency, apply mitigation hierarchy and reduce project related greenhouse emissions. The project-related impacts and issues associated with resource use, and the generation of waste and emissions need to be assessed in the context of project location and local environmental conditions.
PR 4	**Health and Safety** This requirement addresses the client's responsibility to identify and avoid or minimise the risks and adverse impacts to community health, safety and security. It is the client's responsibility to provide a healthy and safe working environment to all workers.
PR 5	**Land Acquisition, Involuntary Resettlement and Economic Displacement** This requirement applies to physical or economic displacement, that can be full, partial, permanent, or temporary. This PR applies to physical or economic displacement, that can be full, partial, permanent, or temporary. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented. Implementation of the actions necessary to meet this PR is managed through the client's Environmental and Social Action Plan (ESAP) and/or Management System.
PR 6	**Biodiversity Conservation and Sustainable Management of Living Natural Resources** The PR requires projects to assess and characterise the potential project-related opportunities, risks and impacts on biodiversity. '*The baseline assessment will consider, but will not be limited to, loss of habitat, degradation and fragmentation, invasive alien species, overexploitation, migratory corridors, hydrological changes, nutrient loading and pollution, as well as impacts relevant to climate change and adaptation*'. Impacts on Indigenous People should also be assessed.
PR 7	**Indigenous People** This PR applies when a project is likely to affect Indigenous Peoples. The PR recognises that the identities, cultures, lands and resources of Indigenous Peoples are uniquely intertwined and especially vulnerable to changes caused by some types of investments so that their languages, cultures, religions, spiritual beliefs, and institutions may be threatened. If Indigenous

PERFORMANCE REQUIREMENT	DETAILS
	People are likely affected, the client is required to carry out an assessment in line with this PR.
PS 8	**Cultural Heritage** This PR requires projects to protect the cultural heritage from adverse impacts from the Project in line with the Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage and the Convention for the Safeguarding of Intangible Heritage. '*The EBRD also recognises the need for all parties to respect the laws and regulations that pertain to cultural heritage in a project's area of influence and the country of operation's obligations under relevant international treaties and agreements.*'
PS 9	**Financial Intermediaries** This is not applicable to the Project.
PS 10	**Information Disclosure and Stakeholder Engagement** It requires clients to identify and document individuals or groups who are affected or likely to be affected by the project by developing a Stakeholder Engagement Plan (SEP). A SEP has been developed for this Project. The Stakeholder engagement process should be carried out throughout the life of the project and will involve the following: (i) the client's public disclosure of appropriate information so as to enable meaningful consultation with stakeholders, (ii) meaningful consultation with potentially affected parties, and (iii) a procedure or policy by which people can make comments or complaints.

EU Standards and Best Available Technique

Based on EBRD PR 3 on Pollution Prevention and Control, '*Where no EU substantive environmental standards at project level exist, the client will identify, in agreement with the EBRD, other appropriate environmental standards in accordance with GIP. In addition, projects will be designed to comply with applicable national law, and will be maintained and operated in accordance with national laws and regulatory requirements. When host country regulations differ from the levels and measures presented in EU environmental requirements or other identified appropriate environmental standards, projects will be expected to meet whichever is more stringent.*'

There are no EU Best Available Techniques Reference Document (BREF) specific to the operation or construction of photovoltaic (PV) plants or to the manufacture of PV panels.

3.3.2 African Development Bank (AFDB)

The AfDB's has an environmental safeguard system (December 2013) to manage environmental and social risks. The Integrated Safeguards System is a tool for identifying risks, reducing development costs and improving project sustainability. It promotes best practices and encourages transparency and accountability. The following safeguards are particularly relevant:

- Operational Safeguard 1: Environmental and social assessment. This operational safeguard includes the requirements for identifying, assessing, and managing the potential environmental and social risks and impacts of a project, including climate change issues. The safeguard document includes requirements for the different stages of the assessment process. The Integrated Environmental and Social Impact Assessment (ESIA) process guidelines are published in the Safeguards and Sustainability Series in three sets (Volume 2 issued 2015);
- Operational safeguard 2: Involuntary resettlement, land acquisition, population displacement and compensation;
- Operational Safeguard 3: Biodiversity and ecosystem services. Requires, inter alia, that as part of the environmental and social assessment, the borrower or client identifies and assesses the potential opportunities for, risks to, and impacts on biological diversity and ecosystem services, including direct, indirect, cumulative and pre-mitigation impacts. It also requires the borrower or client to apply the mitigation hierarchy;
- Operational Safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency. This safeguard covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions, as well as comprehensive industry-specific and regional standards, including greenhouse gas accounting, that other multilateral development banks follow; and
- Operational Safeguard 5: Labour conditions, health and safety. Includes requirements regarding working conditions, such as the management of worker relationships, workers organisations, non-discrimination, retrenchment, and the grievance mechanism, and it includes safeguards for the pretention of the workforce, addressing, for example, child labour.

Volume 3: Sector Keynotes (2015) provides a summary of the activities, typical environmental and social impacts, and potential mitigation and management measures relating to the different sectors. The Energy / electricity sector: solar power keynote was taken into consideration while drafting the ESIA report.

3.3.3 Equator Principles III (2013)

The Equator Principles (EPs) are a voluntary set of guidelines for assessing and managing environmental and social risks in project financing and have become the project finance industry standard for addressing environmental and social issues in project financing globally.

In accordance with Equator Principles III, projects located in Non-Designated Countries (i.e. including Egypt), the Assessment process evaluates compliance with the applicable IFC Performance Standards on Environmental and Social Sustainability (Performance Standards) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

The Equator Principles consist of the following 10 Principles:

Table 3-3 Equator Principles III (2013)

EQUATOR PRINCIPLE	DETAILS
Principle 1	**Review and Categorisation** EPFIs will categorise a project proposed for financing based on the magnitude of its potential impacts and risks in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC). These categories are: **Category A-** Projects with potential significant adverse social or environmental risks and/or impacts that are diverse, irreversible or unprecedented; **Category B** – Projects with potential limited adverse social or environmental risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and **Category C** – Projects with minimal or no social or environmental risks and/or impacts. Based on the size of the Project and Associated Facilities, the **200 MW Kom Ombo PV Solar Plant is likely to be classified under Category B** according to Equator Principle 1, however the category will be determined by the Lenders based on their own risk assessment.
Principle 2	**Environmental and Social Assessment** For all Category A and Category B Projects, the EPFI will require the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialised studies may also need to be undertaken. Furthermore, in limited high-risk circumstances, it may be appropriate for the client to complement its Assessment Documentation with specific human rights due diligence. For other Projects, a limited or focused environmental or social assessment (e.g. audit), or straightforward application of environmental siting, pollution standards, design criteria, or construction standards may be carried out.
Principle 3	**Applicable Environmental and Social Standards** The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. EPFIs operate in diverse markets: some with robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment; and some with evolving technical and institutional capacity to manage environmental and social issues. The EPFI will require that the Assessment process evaluates compliance with the applicable standards as follows: • For Projects located in Non-Designated Countries, the Assessment process evaluates compliance with the then applicable IFC Performance Standards on Environmental and Social Sustainability

EQUATOR PRINCIPLE	DETAILS
	(Performance Standards) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) (Exhibit III). • For Projects located in Designated Countries, the Assessment process evaluates compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues. Host country laws meet the requirements of environmental and/or social assessments (Principle 2), management systems and plans (Principle 4), Stakeholder Engagement (Principle 5) and, grievance mechanisms (Principle 6). The Assessment process will establish to the EPFI's satisfaction the Project's overall compliance with, or justified deviation from, the applicable standards. The applicable standards (as described above) represent the minimum standards adopted by the EPFI. The EPFI may, at their sole discretion, apply additional requirements.
Principle 4	**Environmental and Social Management System and Equator Principles Action Plan** For all Category A and Category B Projects, the EPFI will require the client to develop or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree an Equator Principles Action Plan (EPAP). The Equator Principles AP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.
Principle 5	**Stakeholder Engagement** For all Category A and Category B Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an on-going process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation. To facilitate Stakeholder Engagement, the client will, commensurate to the Project's risks and impacts, make the appropriate Assessment Documentation readily available to the Affected Communities, and where relevant Other Stakeholders, in the local language and in a culturally appropriate manner. The client will take account of, and document, the results of the Stakeholder Engagement process, including any actions agreed resulting from such process. For Projects with environmental or social risks and adverse impacts, disclosure should occur early in the Assessment process, in any event before the Project construction commences, and on an on-going basis. A SEP has been developed for this Project.
Principle 6	**Grievance Mechanism** For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.

EQUATOR PRINCIPLE	DETAILS
	The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. The mechanism should not impede access to judicial or administrative remedies. The client will inform the Affected Communities about the mechanism in the course of the Stakeholder Engagement process.
Principle 7	**Independent Review** ***Project Finance*** For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance. The Independent Environmental and Social Consultant will also propose or opine on a suitable Equator Principles AP capable of bringing the Project into compliance with the Equator Principles, or indicate when compliance is not possible. ***Project-Related Corporate Loans*** An Independent Review by an Independent Environmental and Social Consultant is required for Projects with potential high-risk impacts including, but not limited to, any of the following: • Adverse impacts on indigenous peoples • Critical Habitat impacts • Significant cultural heritage impacts • Large-scale resettlement In other Category A, and as appropriate Category B, Project-Related Corporate Loans, the EPFI may determine whether an Independent Review is appropriate or if internal review by the EPFI is sufficient. This may consider the due diligence performed by a multilateral or bilateral financial institution or an OECD Export Credit Agency, if relevant.
Principle 8	**Covenants** An important strength of the Equator Principles is the incorporation of covenants linked to compliance. For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects. Furthermore, for all Category A and Category B Projects, the client will covenant the financial documentation: a) To comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects; and b) To provide periodic reports in a format agreed with the EPFI (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third-party experts, that i) document compliance with the ESMPs and Equator Principles AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country environmental and social laws, regulations and permits; and c) To decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

EQUATOR PRINCIPLE	DETAILS
	Where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance to the extent feasible. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, as considered appropriate.
Principle 9	**Independent Monitoring and Reporting** ***Project Finance*** To assess Project compliance with the Equator Principles and ensure on-going monitoring and reporting after Financial Close and over the life of the loan, the EPFI will, for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFI. ***Project-Related Corporate Loans*** For Projects where an Independent Review is required under Principle 7, the EPFI will require the appointment of an Independent Environmental and Social Consultant after Financial Close, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFI.
Principle 10	**EPFIs Reporting** ***Client Reporting Requirements*** The following client reporting requirements are in addition to the disclosure requirements in Principle 5. For all Category A and, as appropriate, Category B Projects: • The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online. • The client will publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO2 equivalent annually. Refer to Annex A for detailed requirements on GHG emissions reporting. ***EPFI Reporting Requirements*** The EPFI will report publicly, at least annually, on transactions that have reached Financial Close and on its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations. The EPFI will report according to the minimum reporting requirements detailed in Annex B.

3.3.4 IFC Performance Standards on Environmental and Social Sustainability

The IFC Performance Standards are a key component of the IFC's Sustainability Framework and directed towards clients (i.e. party responsible for implementing and operating the project that is being financed), providing guidance on how to identify risks and impacts. The IFC Performance Standards are designed to help avoid, mitigate, and manage risks and impacts throughout the life of a project as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities.

The 2006 version of the IFC Performance Standards was reviewed and made applicable to all new projects from 1st January 2012. The updated IFC PSs reflect IFC's stronger commitment to climate change, business and human rights, corporate governance and gender equality as well as strengthening the due diligence process for IFIs. Such updates include comparable labour terms for migrant and non-migrant workers, clarification of levels of stakeholder engagement, monitoring of supply chains and an enhanced focus on energy efficiency.

IFC is a shareholder in ACWA Power, and therefore all ACWA Power projects must comply with the IFC Performance Standards and IFC EHS Guidelines.

The following presents the IFC Performance Standards (2012) and their main characteristics:

Table 3-4 IFC Performance Standards (2012)

PERFORMANCE STANDARD	DETAILS AND REQUIREMENTS
PS 1	**Assessment and Management of Environmental and Social Risks and Impacts** It underscores the importance of managing environmental and social performance throughout the life of a project. It requires the Client to conduct a process of environmental and social assessment, and establish and maintain an Environmental and Social Management System (ESMS) appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. The ESMS must be a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders. • Requires stakeholder engagement beyond Affected Communities; • Clarifies levels of stakeholder engagement under different circumstances; • Requires development of a formal environmental and social policy reflecting principles of the Performance Standards; • Introduces participatory monitoring (when appropriate) as an option during implementation; and • Requires periodic performance reviews by senior management.
PS 2	**Labour and Working Conditions** Recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental1 rights of workers. The requirements set out in this PS have been in part guided by a number of international conventions and instruments, including those of the International Labour Organization (ILO) and the United Nations (UN) • Establishes requirement for comparable terms and conditions for migrant workers compared to non-migrant workers; • Introduces quality requirements for workers' accommodation; • Requires ongoing monitoring of working conditions for workers under the age of 18 years old; • Requires establishing policies and procedures to manage and monitor compliance of third parties with this PS; • Requires alternatives analysis in case of retrenchment; and • Requires ongoing monitoring and "safety' trigger in primary supply chain.

PERFORMANCE STANDARD	DETAILS AND REQUIREMENTS
PS 3	**Resource Efficiency and Pollution Prevention** Outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. During the project life-cycle, the client will consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention principles and techniques that are best suited to avoid, or where avoidance is not possible, minimize adverse impacts on human health and the environment.3 The principles and techniques applied during the project life-cycle will be tailored to the hazards and risks associated with the nature of the project and consistent with good international industry practice (GIIP). • Introduces a resource efficiency concept for energy, water and core material inputs; • Strengthens focus on energy efficiency and greenhouse gas measurement; • Reduces greenhouse gas emissions thresholds for quantification and reporting to IFC from 100,000 tons of CO_2 to 25,000 tons of CO_2 per year; • Introduces concept of "duty of care" for hazardous waste disposal; and • Requires determination of accountability with regards to historical pollution.
PS 4	**Community Health, Safety and Security** Addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups. This PS addresses potential risks and impacts to the Affected Communities from project activities. Occupational health and safety requirements for workers are included in PS 2, and environmental standards to avoid or minimize impacts on human health and the environment due to pollution are included in PS 3. • Requires evaluation of the risks and impacts to the health and safety of the Affected Communities during the project life- cycle and the establishment of preventive and control measures consistent in line with GIIP • Considers risks to communities associated with use and/or alteration of natural resources and climate change through an ecosystems approach.
PS 5	**Land Acquisition and Involuntary Resettlement** Recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use. Where involuntary resettlement is unavoidable, it should be minimized and appropriate measures to mitigate adverse impacts on displaced persons and host communities3 should be carefully planned and implemented. • Extends scope of application to restrictions on land use; • Strengthens requirements regarding consultations; and • Introduces a requirement for a completion audit under certain circumstances.

Performance Standard	Details and Requirements
PS 6	**Biodiversity Conservation and Sustainable Management of Living Natural Resources** Addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project's lifecycle in order to protect and conserve biodiversity; to maintain the benefits from ecosystem services; and to promote the sustainable management of living natural resources through the adoption of practices that integrates conservation needs and development priorities. • Clarifies definitions of and requirements for various types of habitats; • Introduces stronger requirements for biodiversity offsets; and • Introduces specific requirements for plantations and natural forests as well as for management of renewable natural resources.
PS 7	**Indigenous People** It requires clients to anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts and to promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. It also requires the client to establish and maintain an on-going relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle. • Expands consideration of Indigenous Peoples' specific circumstances in developing mitigation measures and compensation; • Introduces requirement for land acquisition due diligence with regards to lands subject to traditional ownership or under customary use; and • Introduces the concept of Free, Prior and Informed Consent under certain circumstances.
PS 8	**Cultural Heritage** Aims to ensure that clients protect cultural heritage from the adverse impacts of project activities and support its preservation and promote the equitable sharing of benefits from the use of cultural heritage in line with the Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage.

3.3.5 IFC EHS Guidelines (2007)

The World Bank Group International Finance Corporation (IFC), Environmental, Health and Safety (EHS) General Guidelines of April 2007 superseded the World Bank Handbook issue of 1998.

In terms of specific guidelines to control environmental externalities (e.g. wastewater quality etc.), EHS guidelines have been set out by IFC and the World Bank Group to provide general guidelines for its members when involved in a project or when providing financial support to a project. These guidelines contain general and industry-specific examples of Good International Industry Practice (GIIP).

In summary, it should be noted that the following IFC EHS Guidelines are relevant to this project:

- General EHS Guidelines, Environmental:

- Air Emissions and Ambient Air Quality;
- Energy Conservation;
- Wastewater and Ambient Water Quality;
- Water Conservation;
- Hazardous Materials Management;
- Waste Management;
- Noise; and,
- Contaminated Land.

- General EHS Guidelines, Occupational Health & Safety:
  - General Facility Design and Operation;
  - Communication and Training;
  - Physical Hazards;
  - Chemical Hazards;
  - Biological Hazards;
  - Radiological Hazards;
  - Personal Protective Equipment (PPE);
  - Special Hazard Environment; and,
  - Monitoring.
- Community Health & Safety:
  - Water Quality and Availability;
  - Structural Safety of Project Infrastructure;
  - Life and Fire Safety (L&FS);
  - Traffic Safety;
  - Transport of Hazardous Materials;
  - Disease prevention; and,
  - Emergency Preparedness and Response.

4 APPROACH TO ESIA

4.1 ESIA Team

5 Capitals and EDG

ACWA Power has engaged 5 Capitals Environmental & Management Consulting (5 Capitals) to lead the environmental and social process with regard to this project. This includes supporting project consortium up to Financial Close with their prospective lenders.

In order to ensure that the project meets the Egyptian Environmental Affairs Agency (EEAA) expectations and is submitted by a registered Egyptian consultancy, 5 Capitals has partnered with Environment & Development Group (EDG), who will be responsible for elements of the ESIA process, including baseline studies submission and liaison with EEAA and the necessary consultations.

The team of specialists for this Project are presented in the tables below.

Table 4-1 5 Capitals' Project ESIA Team

Name	Role within ESIA
Ken Wade	Project Director
Reem Jabr	Project Manager and ESIA Specialist
Max Burrow	ESIA Specialist
Eva Muthoni Kimonye	ESIA Specialist

Table 4-2 EDGs' Project Team

Name	Role within ESIA
Dr. Mohamed Farouk	ESIA Team Leader
Dr. Mostafa Saleh	Environmental Management Expert
Dr. Mahmoud Younes	Field Survey Team Leader/Desert Ecologist
Dr. Foad Fathy	Biodiversity Specialist/Animal Ecologist
Mariam Saleh	ES Assessment Specialist/Sociologist
Heba Amer	Community Engagement Specialist/Sociologist
Merna Ghaly	ESIA Specialist

4.2 ESIA Methodology

This section provides information about the data collection and consultation process followed to inform the ESIA and the methodology that has been used to describe the sensitivity of environmental receptors; predict the magnitude of environmental impacts and assess the significance of impacts upon applicable environmental parameters.

4.2.1 Baseline Studies and Research

Forming an integral part of the ESIA, the baseline surveys provide a benchmark of the existing conditions by which the potential impacts of the proposed project can be assessed for the construction and operational phase.

This ESIA has been informed by a review of relevant desktop information as well as a series of physical site surveys which have been summarised in the relevant environmental and social impact assessment chapters of this report. The environmental baseline surveys carried out as part of the ESIA included:

Table 4-3 Environmental Baseline Surveys (2020)

Site Surveys	Period
Site Familiarisation,	17th - 18th December 2019
Stakeholder identification and initial consultation with locals at Faris Village	
Noise Monitoring	2nd – 5th February 2020
Air Quality Monitoring	
Soil Sampling	
Terrestrial Monitoring	
Socio-economic data collection (survey and consultation)	

These surveys are described in the ESIA chapters herein, with analysis results provided, and included to the applicable Appendices. Baseline survey reports are provided in **Appendix D** of this report. The surveys were conducted with the intent to provide representative data in regard to the area that may potentially be impacted by the Project.

4.2.2 Project Stakeholder Analysis and Consultations

Consultation with stakeholders is an essential part of the environmental and social assessment process. A key objective of consultation is to establish dialogue with those stakeholders who may be affected by activities of the Project or may have an interest in it, or the outcomes of the ESIA process.

Egyptian Requirements

Based on the accepted approach for conducting EIA for EEAA in Egypt, Projects falling under Category B or above (note: Project advised to be Category B as EEAA) require a scoping consultation exercise to be undertaken, which involves local (project affected) stakeholders. The purpose of the scoping consultation meeting is to introduce the project, advise on the proposed EIA process, obtain feedback from stakeholders on the proposed project and EIA scope. EEAA requires that stakeholder queries and comments are addressed in the EIA documents.

Lender Requirements

In regard to the lenders EBRD, AfDB and IFC (by extension of EP alignment), include requirements for stakeholder engagement (either in the ESIA, and/or as part of the future ESMS).

EBRD

Effective stakeholder engagement and consultation are a key part of EBRD's Environmental and Social Policy and PRs. The EBRD PR10 on Information Disclosure and Stakeholder Engagement requires that 'Clients conduct stakeholder engagement on the basis of providing local communities that are directly affected by the project and other relevant stakeholders with access to timely, relevant, understandable and accessible information, in a culturally appropriate manner, and free of manipulation, interference, coercion and intimidation'. Stakeholder Engagement must involve the following elements:

- Stakeholder identification and analysis;
- Stakeholder Engagement Plan;
- Disclosure of information, meaningful consultation and participation;
- Grievance mechanism; and
- On-going reporting to relevant stakeholders.

Stakeholder Engagement for the Project should be proportionate to the nature and scale of its potential adverse impacts on the affected communities and the sensitivity of the environment.

AfDB

Based on AFDB Operational Safeguard 1 (OS1) states '*borrower or client shall be responsible for conducting and providing evidence of meaningful consultation'. Consultation should be based on stakeholder analysis and is preceded by disclosure of adequate project information and environmental and social information to ensure that participants are fully informed*

IFC

IFC Performance Standard 1 on "Social and Environmental Assessment and Management Systems" states the following:

"Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an on-going process that may involve, in varying degrees, the following elements:

- *Stakeholder analysis and planning;*
- *Disclosure and dissemination of information;*

- *Consultation and participation;*
- *Grievance mechanism; and*
- *On-going reporting to Affected Communities.*

The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development."

Project Stakeholder Analysis

Several stakeholders were identified. These include community stakeholders who may potentially be affected by the project, whether directly or indirectly, as well as other interested parties, such CSOs and NGOs and institutional stakeholder who may be involved in one way or another in the construction or subsequent operation of the Project. Stakeholders, and their relevance to the project are listed below:

- **Potentially Affected People (PAP)**: Faris villagers who may be directly or indirectly affected by the project. Those include:
  - **Directly Affected PAP**
    - Unemployed youth and those with unstable jobs
    - High school and university students
    - The Faris Contractors Union
    - Users of the Luxor – Aswan Western Highway
  - **Indirectly Affected PAP** (the community at large), including:
    - Farmers
    - Employees
    - Pensioners
    - Women
    - Youth
    - Children
    - People with disabilities
  - **Interested Parties:** stakeholders who are not necessarily affected by the Project, but may be interested and/or involved in it
    - Members of the Civil Society
      - Developmental Organizations
      - Organizations working in the field of environment
    - **Institutional stakeholders:** involved in construction and/or operation of the Project
      - National-Level Stakeholders
        - New and Renewable Energy Authority: Competent Administrative Authority and land owner

- Egyptian Electricity Transmission Company (EETC): electricity off-taker, responsible for construction and operation of transmission substation
- Egyptian Electricity Regulatory Authority: issuing the construction permit and power generation permit
- Egyptian Environmental Affairs Agency: reviewing and approving the ESIA and issuing the environmental permit

▪ Governorate-Level Stakeholders

- Governorate of Aswan: the local government
- Governorate's Environmental Management Office: inspecting the project and ensuring compliance with its Environmental and Social Management Plan
- Civil Protection Authority: approving the firefighting plan
- Governorate's Labour Office: inspecting the project and ensuring compliance with the Egyptian Labour Law
- Faris local council: management of village resources

Method

Based on this breakdown, the socioeconomic team designed focus group discussions to include members of the community who may be directly or indirectly affected by the project. Furthermore, an interview was conducted with the head of the Faris Contractors Union and one of the community leaders to further understand the community's expectations pertaining to direct and indirect positive impacts of the Project. While there were a few civil society organizations in the Village, they appeared to be not very active, expect for the Farmers' Association, which the team met with its head. Finally, for institutional stakeholders, the team met with the Head of the Local Council to further understand the local government's view of the Project, as well as a representative of NREA to understand the role of the different institutional stakeholders.

Project Consultation and Engagement

Scoping consultation and preliminary group sessions were held on the 18th and 19th of December 2019 with the local community at Faris Village and included the following:

Scoping meetings: A scoping session was carried out on the 17th of December at Faris Village Head house and was attended by the village elders to introduce the Project and commencement of the ESIA study. During the meeting, village elders discussed their expectations and concerns which are summarised in the Table below. This was followed by a visit to the local council office, where the project and study were also introduced.

The ESIA team requested to hold additional meetings with the female and male community members to discuss the project and ensure the involvement of the potentially affected community from the beginning of the study.

Plate 4-1 Preliminary Group Meetings/Consultation with Representatives of the Local Community at Faris Village (18th December 2019) – Compilation of Photographs


Additional meetings were held on the 18th of December 2019, one meeting was attended by 24 men from the local community and other meetings were held with three (3) women separately at their homes. The meetings started by introducing the project and explaining the purpose of the ESIA, as well as the consultation activities, and that additional meetings will be conducted as part of the baseline survey data collection. This was followed by enquiring about the socioeconomic conditions of the village to further understand the nature of the people and help prepare for community consultation activities.

Focus Group Discussions (FGD) and key informant interviews (KIIs) with potentially affected communities, as well as KIIs with some institutional stakeholders.: FGM and KII were held on the 2nd and 3rd of February 2020 as detailed in the Table below.

Table 4-4 Focus Group Discussions with Local Community at Faris Village (2 and3 February 2020)

Meetings	Location	No. of Participants	Professions
Focus Group Discussions			
Faris Female Residents	Local House	6	All housewives, five (5) have secondary education and one (1) has a business diploma
Faris Male Residents 1	Local Madyafa (Guest Reception Area)	8	2 retired government employees, 1 farmer (also head of the Local Agricultural Association), 1 NGO head (social development
Faris Male Residents 2	Local Madyafa (Guest Reception Area)	9	4 farmers, 1 driver, 1 retired employee, 3 school/university students
Key Informant Interviews			
Fares Contractors Union (FCU)	Faris Village	1	Mohamed Basheer, Head of FCU
Local Community Leader	Local House	1	Mr. Fouad Serag El Din, Ex-Member of Parliament

Meetings	Location	No. of Participants	Professions
Faris Local Council	Faris Local Council	1	Not identified
New and Renewable Energy Authority (NREA) – Cairo	NREA offices in Cairo	1	Eng. Mohamed Akmal, General Manager – Environmental, Social and Economic Studies

Plate 4-2 Focus Group Meetings with Female and Male Members of the Local Community at Faris Village (2nd February 2020) – Compilation of Photographs


Key consultation feedback

All people in Faris village are aware of the solar power projects to be constructed in Kom Ombo and stated that they have heard of it before 2011, however, it stopped and the government decided to start with the Benban Solar Park instead. While they are all welcoming of the project, they also feel that it will take a piece of their desert land that could have been used for alternative, more labor-intensive, developmental purposes for the villagers (e.g. land reclamation projects), and so they feel entitled to benefit from the project. Given their knowledge of Benban, villagers are aware that the majority of job opportunities are in the construction phase, and are thus temporary. As such, they are more interested in community development projects that they would like the project to help them with as part of their corporate social responsibility. These projects include (1) a healthcare unit; (2) a sewer system; (3) a packaging factory for dates; (4) a packaging factory for mango; (5) a processing factory for doum palm; and/or (6) solar irrigation pumps.

4.2.3 Impact Assessment Significance Criteria

In order to obtain a credible assessment of environmental impacts, the assignment of 'effect significance' to each identified impact needs to be a robust, consistent and transparent process. The methodology to assess 'effect significance' is outlined below and follows an

International Best Practice guideline[2] based on the assumption that the significance of an impact on resources or receptors is considered to result from an interaction between three factors:

- The nature and magnitude of the impact (i.e. a change in the environment, social and/or health baseline conditions);
- The number of resources or receptors affected (i.e. humans and the environment); and
- The environmental value or sensitivity of those resources or receptors to the change.

A three-step approach has been used to determine the significance of environmental effects, as follows:

- **Step 1** – Evaluation of value/sensitivity of resource or receptor;
- **Step 2** – Assessing the magnitude of the impact on the resource or receptor; a
- **Step 3** – Determining the significance of impacts

Identification and Evaluation of Sensitive Receptors

Sensitive receptors are defined as:

- Elements of the **environment** that are of value to the functioning of natural systems (i.e. areas or elements of ecological, landscape or heritage value, species, habitats and ecosystems, soil, air and water bodies or land-use patterns); and
- **Human** receptors, such as stakeholders (i.e. users of dwellings, places of recreation, places of employment, community facilities or household relocation) and human systems (e.g. employment market, population disease susceptibility and disease communicability, exposure to toxicity of chemicals).

The environmental value (or sensitivity) of the environmental and social value (or sensitivity) of the resource or receptor has been defined by using the criteria in the Table below.

Table 4-5 Environmental Value of Receptor or Resource

Value (sensitivity)	Description of Value
Very High	• High importance and rarity on an international scale and limited or no potential for substitution.

[2] See for example Scottish Natural Heritage (2009) A handbook on environmental impact assessment or Highways Agency (2008) Assessment and Management of Environmental Effects design manual for roads and bridges HA 205/08 Volume 11, Section 2, Part 5.

Value (sensitivity)	Description of Value
	• The receptor has already reached its carrying capacity, so any further impact is likely to lead to an excessive damage to the system that it supports. • Locations or communities that are highly vulnerable to the environmental impact under consideration or critical for society (e.g. indigenous peoples, hospitals, schools).
High	• High importance and rarity on a national scale, and limited potential for substitution. • The receptor is close to reaching its carrying capacity, so a further impact may lead to a significant damage to the system that it supports. • Locations or communities that are particularly vulnerable to the environmental impact under consideration (e.g. residential areas, vulnerable/marginalized groups).
Medium	• High or medium importance and rarity on a regional scale, limited potential for substitution. • The receptor is already significantly impacted, but it is not close to reaching its carrying capacity. Further impacts will get increase the stress of the underlying system, but evidence does not suggest that it is about to reach a critical point. • Locations or groups that are relatively vulnerable to the environmental impact under consideration (e.g. commercial areas).
Low	• Low or medium importance and rarity on a local scale. • The receptor is not significantly impacted and shows a large spare carrying capacity. Impacts are not likely to generate any noticeable stress in the underlying system. • Locations or groups that show a low vulnerability to the environmental impact under consideration (e.g. industrial areas).
Very Low	• Very low importance and rarity on a local scale. • The receptor is not impacted and shows a very large spare carrying capacity. Impacts are very unlikely to generate any noticeable stress in the underlying system. • Locations or groups that show a very low vulnerability to the environmental impact under consideration (e.g. industrial areas).

The existence of receptors that are legally protected (e.g. designated areas, protected habitats or species) will be taken into consideration for the assessment of the sensitivity of the receptors.

Identification and Evaluation of Potential Impacts

The following types of impacts have been considered in line with 5 Capital's assessment methodology:

- Direct Impacts - Potential impacts that may result from the construction and occupation of the Project acting directly on an environmental or social receptor (e.g. land take for construction of the camps);
- Indirect Impacts – Potential impacts which are not a direct result of a Project activity, often produced later in time or further removed in distance, but are normally a result of a complex pathway (e.g. dust deposition on vegetation which causes reduction in photosynthetic rates);
- Beneficial Impacts – Impacts that have a positive, desirable or favourable effect on the sensitive resources or receptors (e.g. landscape providing artificial habitat for a variety of species, creating jobs during the construction and/or occupation phases of a project);
- Adverse Impacts – Impacts that are detrimental and have a negative influence on sensitive resources or receptors;
- Event Related Impacts - Potential unplanned or accidental impacts stemming from an unintentional event such as fire, explosion, oil spill, etc. taking into consideration likelihood of occurrence;
- Cumulative Impacts - The additive potential impacts that may result from the incremental potential impacts of the planned Project plus the potential impacts of reasonably anticipated future projects or future phases of a same development.

The magnitude of the impact refers to the extent of change that is anticipated to occur for the receptor(s) under consideration and is considered as a function of:

- Extent/scale;
- Duration;
- Frequency; and
- Likelihood of occurrence.

In other words, the criterion that has been used for assessing the magnitude of impacts includes: the geographical scale of the impact, the permanence of impact and the reversibility of the impacted condition. A brief description of the magnitude of the impacts is provided in the Table below.

Table 4-6 Criteria for Magnitude of Impacts

Magnitude of Impact	Description of Magnitude
Major	***Adverse***: Loss of resource and/or quality and integrity; severe damage to key characteristics, features or elements. A major impact is usually large scale, permanent and irreversible. ***Beneficial***: Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Moderate	***Adverse***: Significant impact on the resource, but not adversely affecting the integrity; Partial loss of/damage to key characteristics, features or elements. Moderate impacts usually extend above the site boundary, and are usually permanent, irreversible or cumulative. ***Beneficial***: Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	***Adverse***: Some measurable change in attributes quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Minor impacts usually are only noticeable within the site and are temporary and reversible. ***Beneficial***: Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	***Adverse***: Very minor loss or detrimental alteration to one or more characteristics, features or elements. Beneficial: Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Determination of Significance of Impacts

Significance of impacts is determined by taking into consideration the sensitivity of an identified receptor or resource and the magnitude of the project impact. That is, the greater the environmental sensitivity of an identified receptor or resource, and the greater the magnitude of impact, the more significant the impact (project impact).

In addition to this, where a project has a major detrimental impact on a highly valued environmental resource/receptor, the consequences of that impact on the said resource would be significant adverse effect. In other words, it is the result of the impact acting on the receptor that produces an environmental effect.

Effects can be either beneficial or adverse. The table below shows the criterion used for determining the significance of environmental impacts. Definitions of each significance categories are provided in Table 4-7.

Table 4-7 Criteria for Determining Significance of Impacts

		MAGNITUDE OF IMPACT (DEGREE OF CHANGE)				
		No change	Negligible	Minor	Moderate	Major
SENSITIVITY OF RECEPTOR	Very High	Neutral	Minor	Moderate to Major	Major	Major
	High	Neutral	Minor	Minor to moderate	Moderate to Major	Major
	Medium	Neutral	Negligible to minor	Minor	Moderate	Moderate to Major
	Low	Neutral	Negligible to minor	Negligible to minor	Minor	Minor to moderate
	Very Low	Neutral	Negligible	Negligible to minor	Minor	Minor

In some cases, above the significance is shown as being one of two alternatives. In these cases, a single description is decided upon with reasoned judgement for that level of significance chosen.

Table 4-8 Definition of Impact Significance

Significance Category	Criteria
Very Large	Only adverse effects are assigned this level of importance as they represent key factors in the decision-making process. Effects are associated with sites and features of national or regional importance. Effects exceed statutory limits. Mitigation measures are unlikely to remove such effects.
Large	Important considerations at a local scale but, if adverse, are potential concerns to the project and may become key factors in the decision-making process. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected communities or interests.
Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource. They represent issues where effects will be experienced but mitigation measures and detailed design work may ameliorate or enhance some of the consequences upon affected communities or interests. Some residual effects will still arise.
Slight	Local issue unlikely to be of importance in the decision-making process. Effects do not exceed statutory limits. Nevertheless, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures.

Significance Category	Criteria
Neutral	No effect or effect that is beneath the level of perception, within normal bounds of variation or within the margin of forecasting error. No mitigation is required.

The approach to assigning significance of impact relies on reasoned argument, professional judgement and taking on board the advice and views of appropriate organisations. For some disciplines it is determined by comparison, wherever possible with company, locally, nationally or internationally accepted standards. If no standards are available then it is necessary to develop project specific limits, based on guidance or best practice as necessary.

Such standards or limits are referred to as the **Significance Threshold**. If the size and type of impact is greater that the significance threshold, then this is termed a **Significant Impact**. Potential significant impacts need to be avoided and are therefore prioritised identifying mitigation measures to reduce the effect to an acceptable level. Significant effects will be those, which are 'Major' or 'Moderate to Major'.

Note: All predicted impacts with a beneficial impact have been colour coded green.

4.2.4 Mitigation and Management Measures

The Project includes a variety of measures to ensure that environmental standards and guidelines can be achieved by the Project. The projects impact assessment process as outlined above will therefore take into consideration those measures included to the projects design. In addition to specific measures included to the projects design, the ESIA will outline further mitigation and/or management measures for the construction and the operational phases, upon which the project can further minimise or avoid negative impacts and ameliorate positive impacts.

Upon approval of the project, the stated mitigation and management measures in the approved ESIA will be required for implementation as a condition of the environmental permit, or as the lenders as part of the loan agreement.

4.2.5 Residual Impacts

Following assessment of the mitigation and management measures, the projects residual impact significance will be considered to determine whether the proposed mitigation and management can be considered acceptable. The significance of such impacts is based upon the same criteria used to determine the impact significance before applying additional mitigation and management measures.

4.2.6 E&S Disclosure

As has been requested by EBRD, there will be a Project E&S disclosure session, to be undertaken in March 2020. The session will involve key stakeholders as identified (above) and as per the Stakeholder Engagement Plan (SEP) developed for this Project. The intention of the session will be to present the outcomes of the ESIA process and to advise of key mitigation and management measures, including key elements of the SEP such as the grievance mechanism and how it can be accessed. Copy of invitation letters sent out to EEAA and NREA are provided in **Appendix E**.

5 AIR QUALITY

5.1 Introduction

This chapter describes and assesses the potential impacts that may occur as a result of the projects construction and operational activities on air quality and identifies measures to be undertaken and implemented in order to mitigate and manage such impacts.

5.2 Standards and Regulatory Requirements

The following section provides the national and international air quality standards which are applicable to the Project. In accordance with lender requirements, where more than one standard is available, the most stringent limit will be utilised for purpose of the ESIA.

5.2.1 National Standards

Ambient air quality is regulated by Environmental Law 4/1994 as amended by Law 9/2009 and its Executive Regulation amended by decree 710/2012. Given that there are no residents in the area monitored, but there are other industrial facilities, the AQ measurements are benchmarked against the 'industrial 'standards.

Table 5-1 Ambient Air Quality

POLLUTANT	AREA	EMISSION LIMIT VALUE IN µG/M3 UNLESS SPECIFIED OTHERWISE			
		HOUR	8 HOURS	24 HOURS	1 YEAR
SO_2	Urban	300	-	125	50
	Industrial	350	-	150	60
CO	Urban	30 mg/m³	10 mg/m³	-	-
	Industrial			-	-
NO_2	Urban	300	-	150	60
	Industrial	300	-	150	80
Total Suspended Particulates TSP	Urban	-	-	230	125
	Industrial	-	-	230	125
Particulates < 10 µm, PM_{10}	Urban	-	-	150	70
	Industrial	-	-	150	70
O_3	Urban	180	120	-	-
	Industrial	180	120	-	-

5.2.2 Lenders Requirements

AFDB

AFDB states '*the borrower or client shall apply pollution prevention and control measures consistent with national legislation and standards, applicable international conventions, and internationally recognized standards and good practice – particularly the World Bank Group Environmental, Health and Safety (EHS) Guidelines*'.

The majority of other lenders (such as Equator Principles Financial Institutions) will also require adherence to the World Bank Group General EHS Guidelines (2007) which reference the World Health Organisation Ambient Air Quality requirements, as detailed below.

Table 5-2 WHO Ambient Air Quality Standards (µg/m³ unless otherwise specified)

PARAMETER	24 HOUR	ANNUAL
PM_{10}	100 (Interim target 2)	50 (Interim target 2)
	75 (Interim target 3)	30 (Interim target 3)
	50 (guideline)	20 (guideline)
$PM_{2.5}$	75 (Interim target 1)	35 (Interim target 1)
	50 (Interim target 2)	25 (Interim target 2)
	37.5 (Interim target 3)	15 (Interim target 3)
	25 (guideline)	10 (guideline)
NO_2	200 (1 hour)	40
SO_2	125 (Interim target 1)	500 (10-minute guideline)
	50 (Interim target 2)	
	20 (guideline)	
O_3	160 (interim target 1) (8-hour daily maximum)	
	100 (8 hour daily maximum guideline)	

Source: World Bank General EHS Guidelines, 2007

EBRD – European

Where EBRD are providing direct project finance, it will be necessary for the project to align with European environmental standards.

The following table presents the ambient air quality standards as established by the European Commission Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, and previous Directives on air quality including 96/62/EC, 1-3 daughter Directives 1999/30/EC, 2000/69/EC, 2002/3/EC, and Decision on Exchange of Information 97/101/EC.

Table 5-3 European Commission Ambient Air Quality Standards (µg/m³ unless otherwise specified)

Pollutant	Averaging Period	Concentration	Permitted Exceedances per Year
Sulphur Dioxide (SO_2)	1-hour	350	24
	24-hour	125	3
Nitrogen Dioxide (NO_2)	1-hour	200	18
	Annual	40	n/a
Carbon Monoxide (CO)	Maximum Daily 8-hour mean	10 mg/m³	n/a
$PM_{2.5}$	Annual	25	n/a
PM_{10}	24-hour	50	35
	Annual	40	n/a
Ozone	Maximum Daily 8-hour mean	120	25 days averaged over 3 years
Lead	Annual	0.5	n/a
Benzene	Annual	5	n/a
Arsenic	Annual	6 ng/m³	n/a
Cadmium	Annual	5 ng/m³	n/a
Nickel	Annual	20 ng/m³	n/a
PAH	Annual	1 ng/m³ (expressed as concentration of Benzo(a)pyrene)	n/a

5.3 Baseline Conditions

The Project is located in a largely remote location in a desert environment of Egypt. The ambient air quality at and around the Project site is primarily expected to be primarily affected by the desert nature of the area, and may also be influenced slightly by emissions from road vehicles using the adjacent road (north of Project site).

Based on the site visits conducted, other visible sources of air emissions in the vicinity of the Project site include:

- Gaseous and particulate emissions (expected to be: NO_2, SO_2, VOCs, Particulates etc.) from the generators used by Faris Contractors Union at the north eastern corner of the site;
- Dust and gaseous emissions (NO_2, SO_2, VOCs, etc.) from the on-going construction activities from TSK PV Project (bordering the Project site to the east);
- Fugitive VOC emissions from the oil production facility located approximately 6 km southwest of the project site; and
- Potential low-level detectable concentrations of pollutants from combustion and various activities in Kom Ombo city.

To gain an indication of the ambient air quality at the Project site and surround area, both a literature review and an air quality monitoring survey was carried out in order to establish the baseline air quality conditions.

Historical Sources of Information

Climatic Profile

Climatological data to inform the ESIA has bene sourced from the Kom Ombo meteorological station located approximately 18km southwest of the project site.

Temperature

Temperature is high throughout most of the year averaging 24.7 °C. January is coldest month of the year with a mean daily average of 15.4°C and ranging from a mean minimum of 7.0°C to a mean maximum of 23.7°C. In June, the hottest month of the year, temperatures average 31.4°C, ranging from 22.1°C to 40.8°C. The absolute highest and lowest temperatures on record are 49.0°C (occurring in June) and – 2.0°C (occurring in February).

Figure 5-1 Monthly mean temperature and its range in Kom Ombo

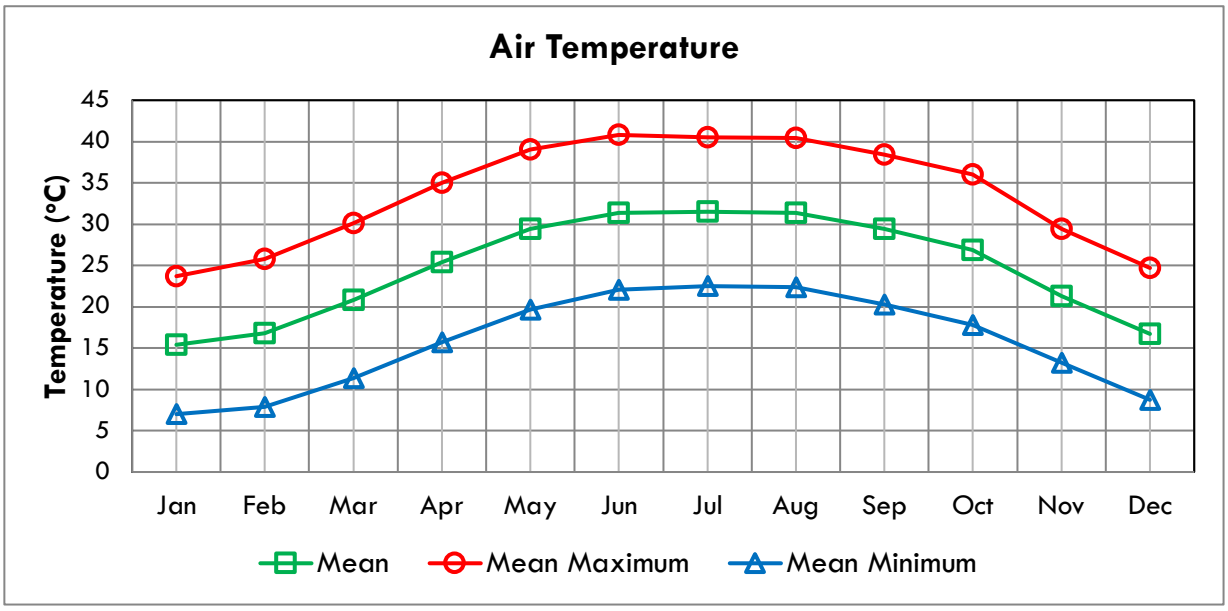


Table 5-4 Maximum, minimum and monthly mean temperature at Kom Ombo

Month	Temperature (°C)				
	Daily Mean	Mean Maximum	Mean Minimum	Absolute Maximum	Absolute Minimum
Jan	15.4	23.7	7	35.0	-0.6
Feb	16.8	25.8	7.9	40.0	-2.0
Mar	20.8	30.1	11.4	47.1	1.5
Apr	25.4	35	15.7	46.0	5.6
May	29.4	39	19.7	48.3	9.2
Jun	31.4	40.8	22.1	49.0	15.0
Jul	31.5	40.5	22.5	47.2	16.0
Aug	31.4	40.4	22.4	48.8	13.8
Sep	29.4	38.4	20.3	47.0	12.8
Oct	26.9	36	17.8	44.8	9.0
Nov	21.3	29.4	13.2	39.2	2.4
Dec	16.7	24.7	8.7	35.6	-1.2
Annual Mean	**24.7**	**33.6**	**15.7**	**44.0**	**6.8**

Rainfall

Upper Egypt, including the Kom Ombo area is typically hyper-arid with very scarce and highly irregular precipitation. According to the climatological records of Kom Ombo, the mean annual rainfall amounts to an average of 1.2 mm. Rainy days most frequently occur in spring months and to a lesser extent, in autumn and early winter months. Rainfall usually occurs as squally highly irregular showers. Downpours equivalent to the average rainfall of a whole year or even several years can fall within few minutes during spring and autumn months. Figure 2 shows a downpour of 6.2 mm or the equivalent of the rain of 5 years falling in one day in Kom Ombo. Rain occurs at an average rate of 1.3 days per year mostly of less than 0.1 mm (0.7 days per year). Forms of precipitation other than rain are insignificant.

Figure 5-2 Mean monthly precipitation and maximum rainfall in one day in Kom Ombo

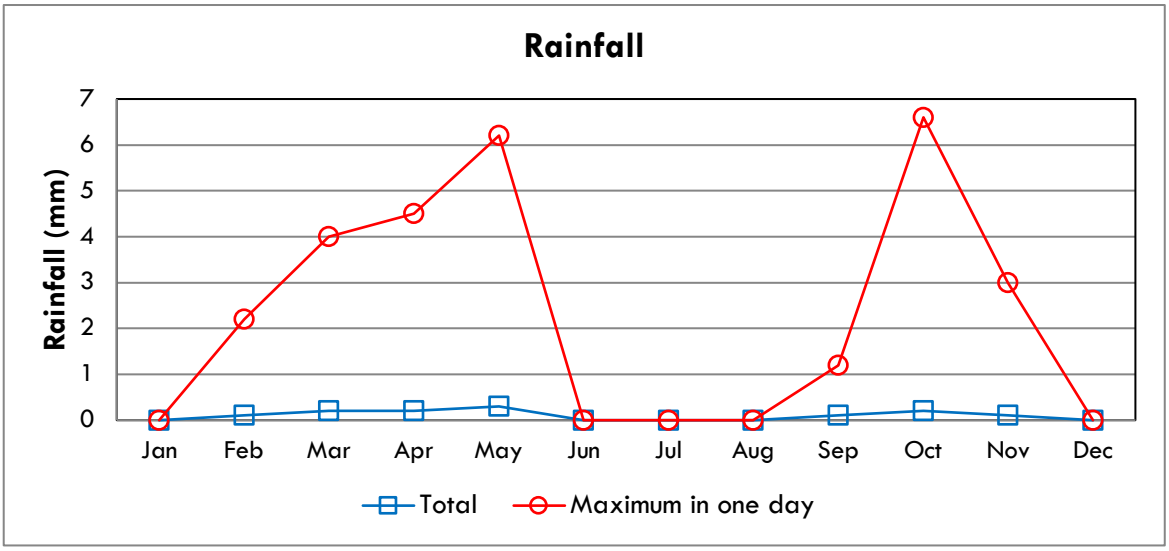


Figure 5-3 Monthly average number of rainy days in Kom Ombo

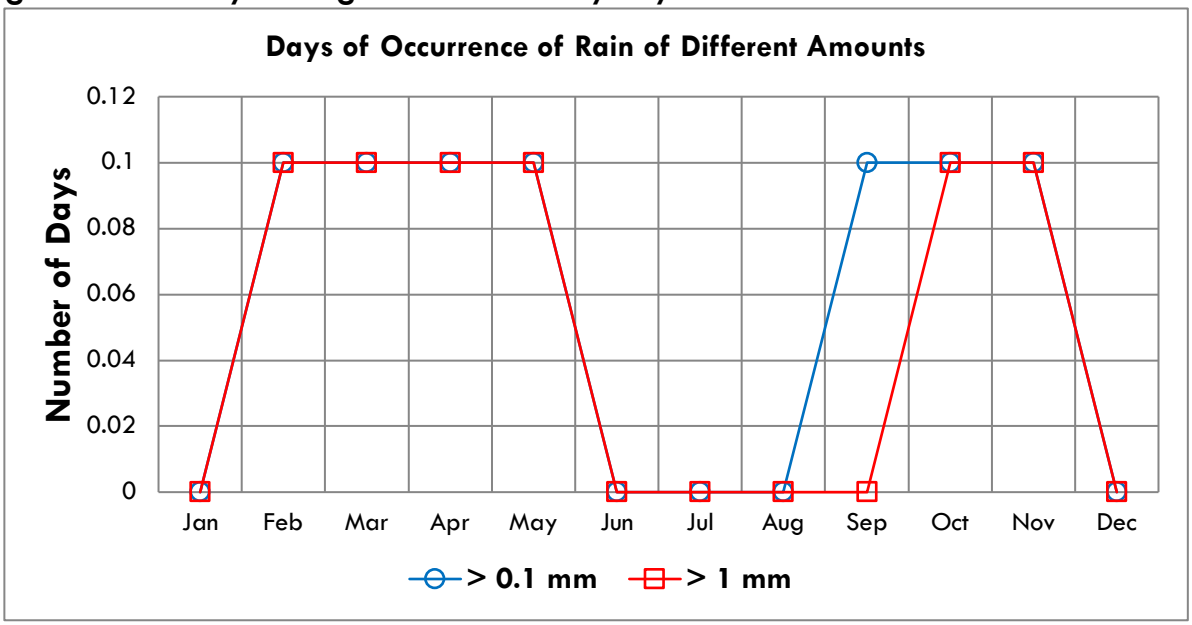
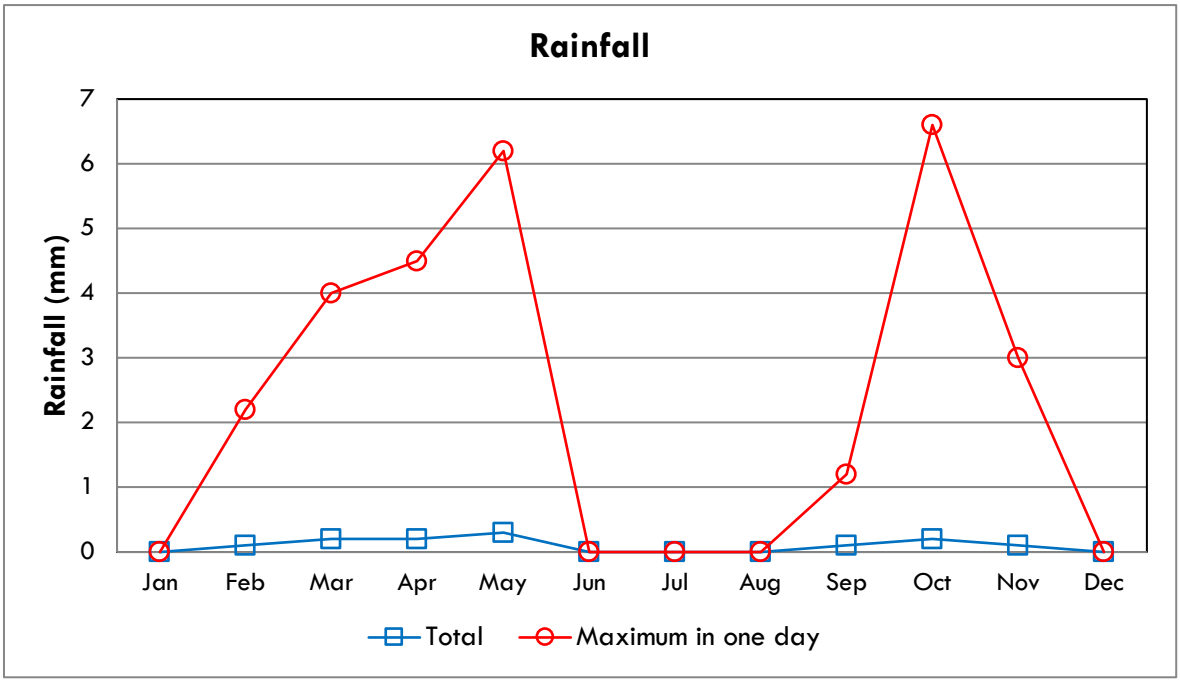


Figure 5-4 Mean total rainfall per day and maximum rainfall per day in Kom Ombo



Relative Humidity and Evaporation Rate

Relative humidity is generally low (Figure 5-5; Figure 5-6), with an average of 30.9% throughout the year, with the highest humidity levels are reported during winter months. Relative humidity is generally lower during midday, with an average of 19%.Like other hyper-arid areas, evaporation rate at the project site is extremely high, averaging at 11 mm per day. Higher evaporation rates occur in summer. The monthly rate of evaporation ranges between 5.4 mm in December to 16.1 mm in June. This high evaporation rate compared to the low precipitation rate (about 1.2 mm per year) makes the Kom Ombo area in general one of the driest areas on earth.

Figure 5-5 Mean monthly relative humidity and evaporation rate in Kom Ombo

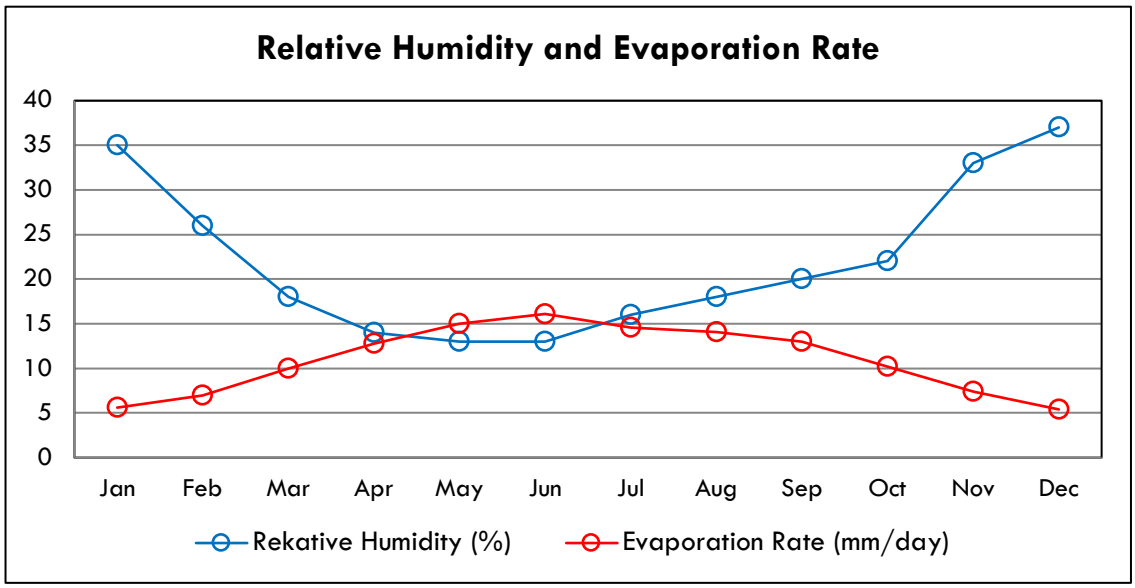
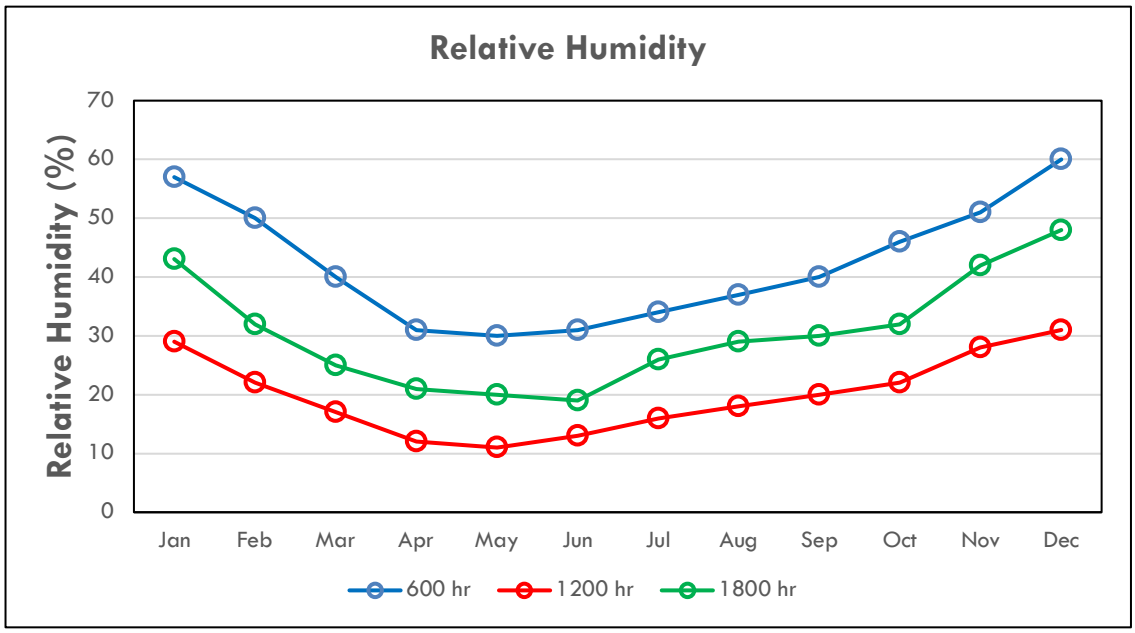


Figure 5-6 Mean monthly daily evaporation rates at different time of day in Kom Ombo



Solar Insolation

Egypt receives more direct solar insolation than most other areas on the globe. In desert areas such as the Kom Ombo project site, solar insolation is extremely high. The sky is usually cloudless during most of the year. Bright sunshine occurs at an average of 76% of potential daytime hours and ranges from a minimum of 67 % in December to a maximum 82.9 in August. Related to this, is the prevailing clear sky conditions, which characterize the region.

The intensity of solar insolation is also affected by other weather conditions such as the occurrence of fog, mist, haze, dust or sand rising. The following figure shows the number of days of occurrence of fog, mist or haze with visibility of less than 1000 meters. The figure shows that fogy days do not occur in the area or are extremely rare. Haze is also very rare but occurs mostly in winter and spring. Days with mist are very rare and can occur any time of the year.

Figure 5-7 Average monthly duration of bright sunshine in Kom Ombo

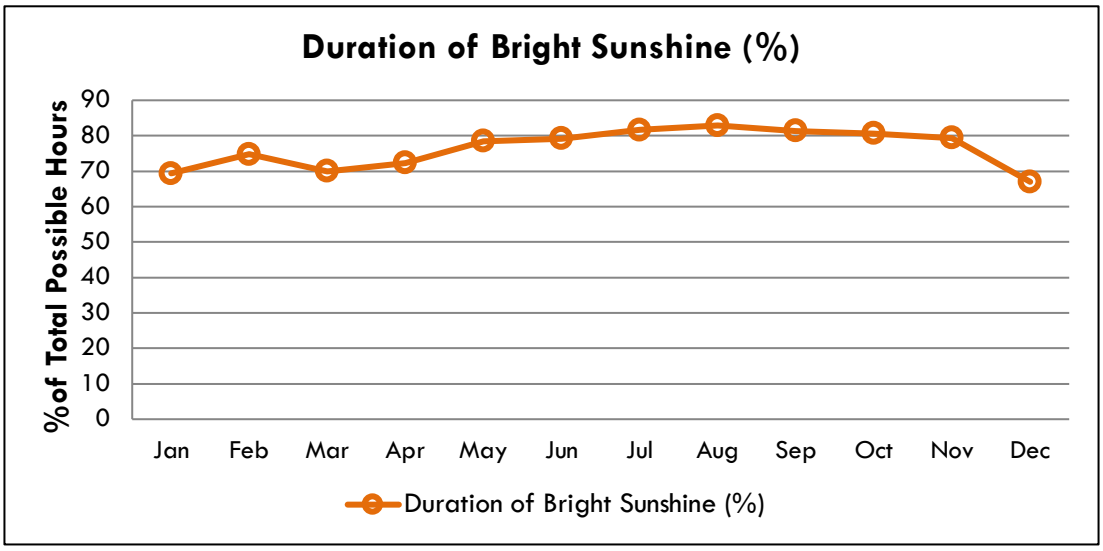


Figure 5-8 Monthly average total sky cover at different time of day in Kom Ombo

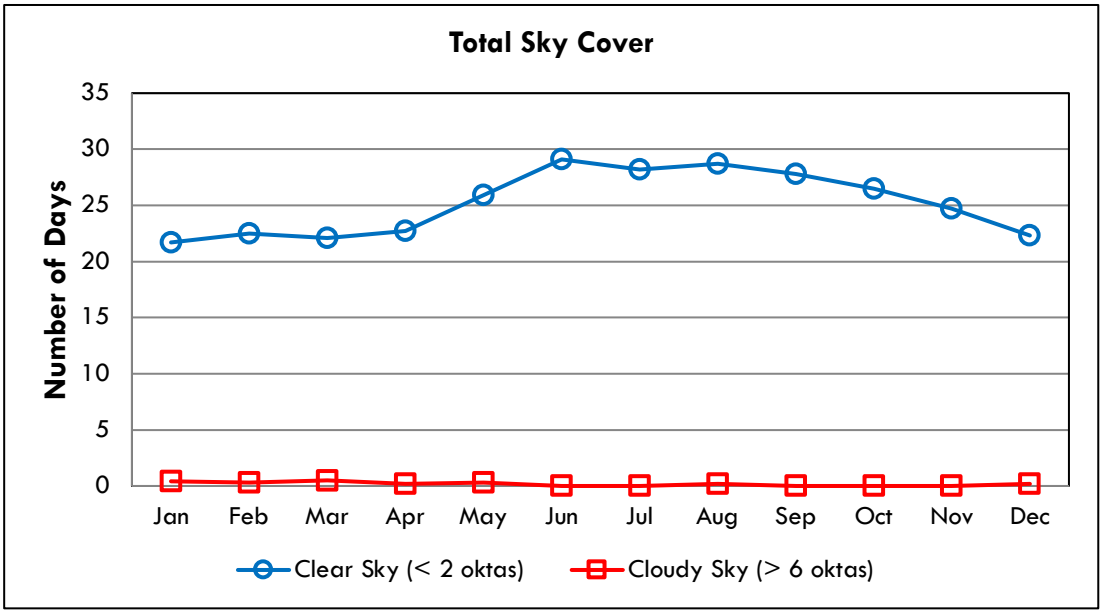
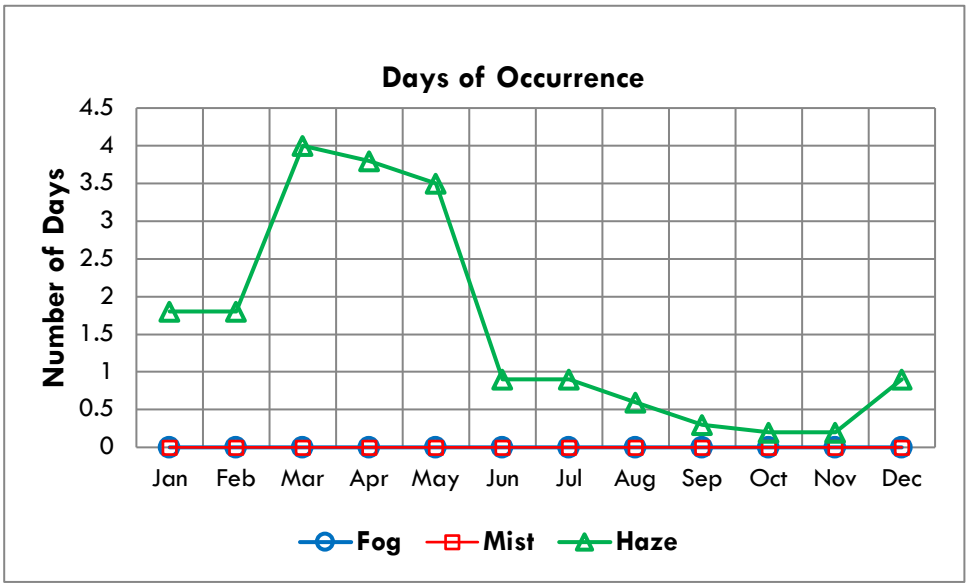


Figure 5-9 Days of occurrence of fog, mist and haze in Kom Ombo



Wind Speed and Direction

Wind regime is highly uniform throughout Egypt and is dominated by northwesterly and northerly winds most of the year. In Kom Ombo, the prevailing wind blows during most of the year, from the northwest, north, or northeast, with a moderate speed averaging 3.6 knots, with March being the windiest month of the year (Figure 5-10). For only a few days during the spring months, transient changes in this rather stable wind pattern occur, with hot desert wind blowing from south, southeast or southwest. This wind, which is known as the *Khamasin* wind, often blows as sand storms of hot desert wind and covering vast areas of Egypt.

In most months, wind speeds of 4 knots or less occur between only 2.2 and 9% of the time. Winds of 7-10 knots is much more common and account for 33.2-44.3% of the observations. Occasional gals occur throughout the year with isolated instances of 28 to 33 knots being on record in spring.

Wind-driven dust and sand rising is more frequent during spring months, totaling 32 days per year. Dust or sand storms occur at a mean frequency of 6.4 days per year mostly during spring months. Gales with surface wind speed of 34 knots or more occur at a frequency of one day per year.

Kom Ombo is subject to wind blowing predominantly from north to south, throughout much of the year shows the monthly wind roses of Kom Ombo. The figure shows that westerly winds prevail during December, January and, representing 40.1, 54.1 and 36.4 %of the wind during that period, respectively.

Figure 5-10 Monthly mean wind speed in Kom Ombo

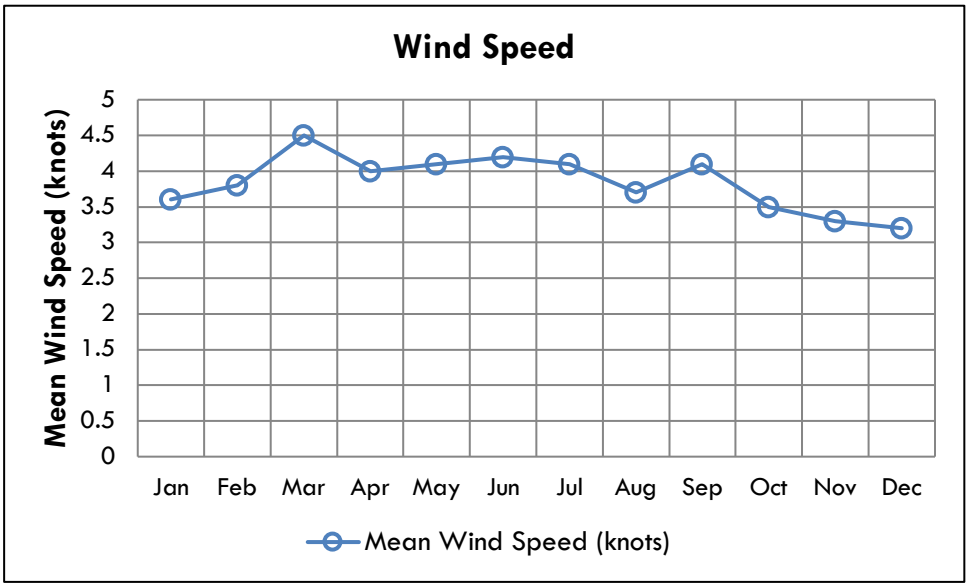


Figure 5-11: Frequency of occurrence of wind speeds ranges occurring in Kom Ombo

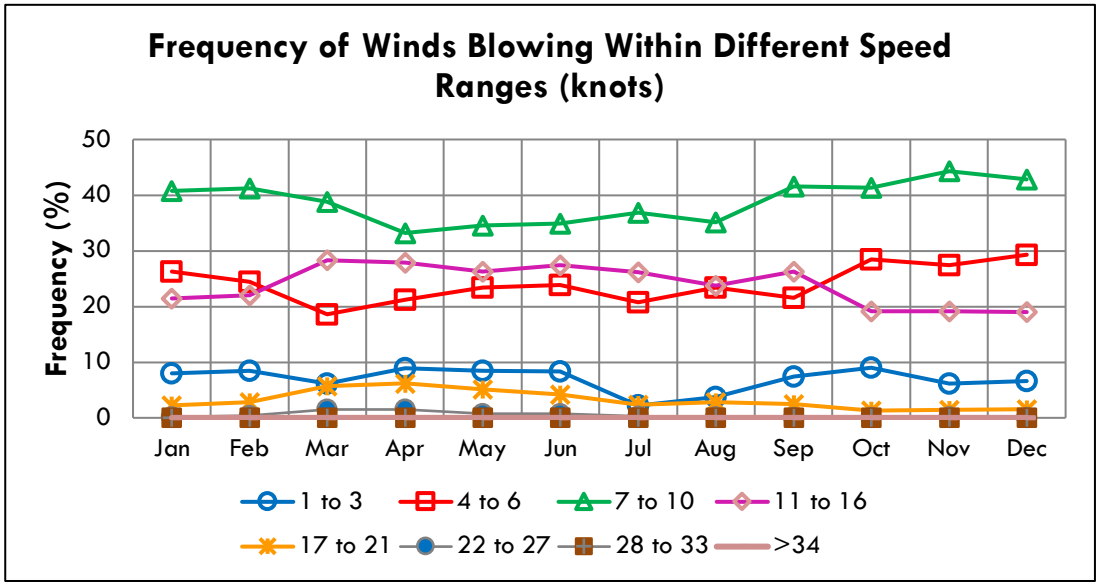


Figure 5-12 Monthly means of number of days of dust and sand rising affecting visibility in Kom Ombo

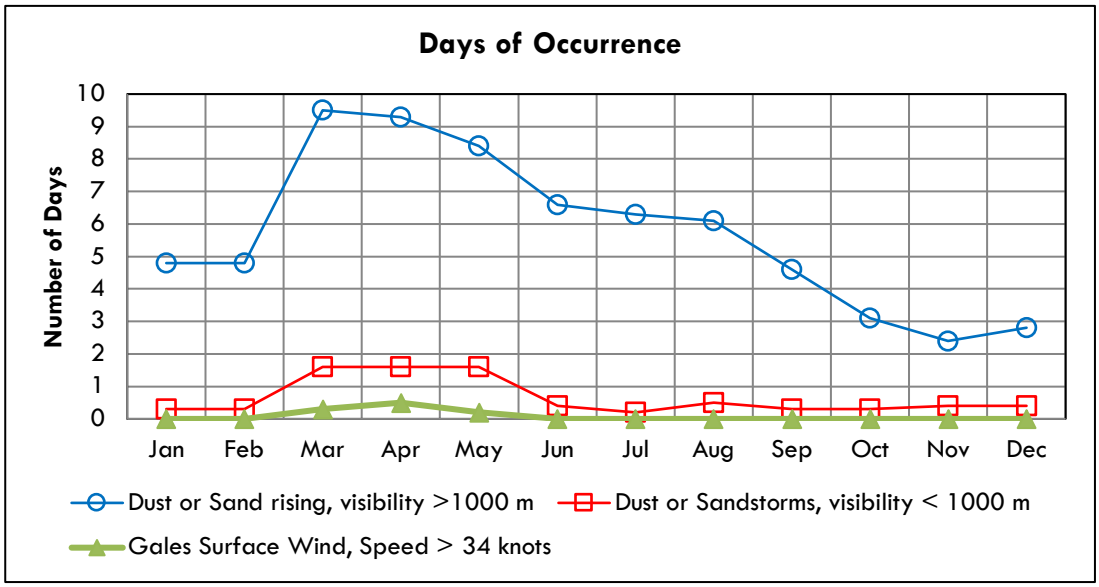
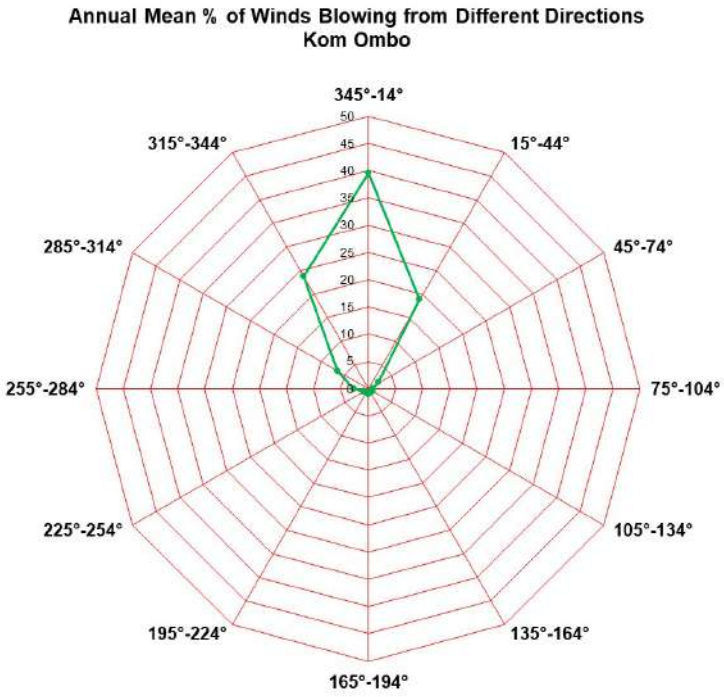


Figure 5-13 Annual Wind Rose of Kom Ombo



Historical Air quality Monitoring

No historical monitoring data for air quality for the Project area prior to construction was found to be available. The Environmental and Social Impact Assessment study undertaken in 2014 for the adjacent PV Project owned by NREA and TSK (DNV GL - Energy, 2014) described the baseline air conditions at the site qualitatively only.

According to the study, the air quality in Kom Ombo City (about 20km southeast of the project site) is considered poor. In 2003 the Kom Ombo air quality monitoring station was one among three (3) stations that exceeded the Egyptian annual average for sulphur dioxide (SO_2) of 60µg/m^3. In addition, the Total Suspended Matter exceeded the Egyptian standards levels during most monitored days (DNV GL - Energy, 2014). An example of emission sources in Kom Ombo is the Kom Ombo Sugar Factory, located approximately 18km south east of the Project site.

Air Quality Monitoring Survey (Project Site)

For an indication of the present ambient air quality (levels at the Project site, an air quality monitoring survey was carried on site towards the north of the site for three (3) consecutive 24-hour cycles between 11:00 on Sunday 2 February, 2020 and 22:00 on Wednesday 5 February 2020. Location of air quality monitoring location is shown in Figure below.

Air quality measurements were conducted in accordance with the requirements stipulated in Annex 5 of the Executive Regulations of Environmental Law 4/1994 (decree 710/2012), covering hourly and daily concentrations of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO). Accordingly, continuous air quality measurements were taken for three consecutive days covering the following parameters:

- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO_2)
- Sulphur Dioxide (SO_2)

Air samples were also taken on filters for measuring total Suspended Particulates (TSP) and Particulates less than 10µm (PM_{10}). Ozone concentration was measured 10 times during the three days of monitoring using colorimetric gas detector tubes. Times of measurements covered different times of day. All measurements were taken at a location was about 180m south of the road and about 980m west of the eastern boundary of the site (24°37'14.17"N, 32°47'58.53"E).

Figure 5-14 Photo of AQ monitoring equipment (left) and ozone colorimetric gas detection tube (right).

Equipment and Standard Methods Used for Sampling and Measurement

Air quality sampling and measurements were based on international standard methods recommended by the American Society for Testing & Materials (ASTM), US Environmental Protection Agency (EPA) and the Japanese Industrial Standards (JIS). These methods are listed in the table below.

Table 5-5 Equipment and Standard Methods Used for Sampling and Measurements

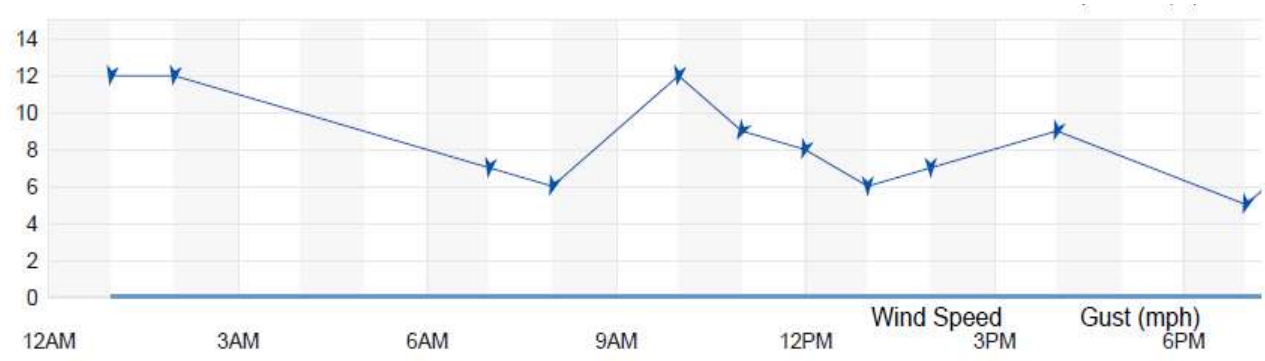
PARAMETER	STANDARD METHOD AND INSTRUMENT/EQUIPMENT
Sulfur Dioxide	JIS Method B 7952, UV Fluorescent Continuous Monitor (Thermo-England)
Nitrogen Dioxide	ASTM Method D 3824, Chemiluminescent Continuous Monitor (Thermo- England)
Carbon Monoxide	ASTM Method D 3162, IR Absorption Continuous Monitor (Thermo-England)
PM10	EPA Compendium Method IO-1.1, Air Metrics Air Sampler (USA)
TSP	EPA Compendium Method IO-2.1, Air Metrics Air Sampler (USA)
Ozone	Colorimetric gas detector tubes

Weather Conditions during Monitoring

The figures below provide an overview of ambient temperature and windspeed during the air quality monitoring period.

Figure 5-15 Temperature (°F) - Weather Conditions during Monitoring

Figure 5-16 Wind Speed and Gusts - Weather Conditions during Monitoring



Measurement Results

Day 1

Table 5-6 Hourly Concentrations of Gases/CO 8h average - Measurement Results for Day 1

DATE	TIME	SO_2 (MG/M3)	NO_2 (MG/M3)	CO (MG/M3)	CO 8H-AV
2/2/2020	11:00	8.4	8.4	1.6	1.54
	12:00	7.6	6.7	1.6	
	13:00	8	6.4	1.6	
	14:00	7.4	6.5	1.5	
	15:00	7.9	7	1.6	
	16:00	7.9	7.8	1.5	
	17:00	7.9	7.1	1.5	
	18:00	7.8	7.4	1.4	
	19:00	7.7	7.5	1.3	1.41
	20:00	7.9	8.4	1.4	
	21:00	7.7	7.2	1.4	
	22:00	7.9	7.4	1.4	
	23:00	8.1	9.4	1.4	
	24:00	7.7	8.7	1.5	
3/2/2020	01:00	7.7	8.6	1.5	
	02:00	7.4	8.9	1.4	
	03:00	7.4	8.5	1.6	1.54
	04:00	7.3	9	1.5	
	05:00	7.5	9.4	1.5	
	06:00	7.2	9.,1	1.5	
	07:00	7	6.9	1.5	
	08:00	7.7	10.2	1.5	
	09:00	7	8.2	1.6	
	10:00	6.5	10.4	1.6	
Hourly Limit Values		**300**	**300**	**30**	**10**

Figure 5-17 Day 1 Measurements

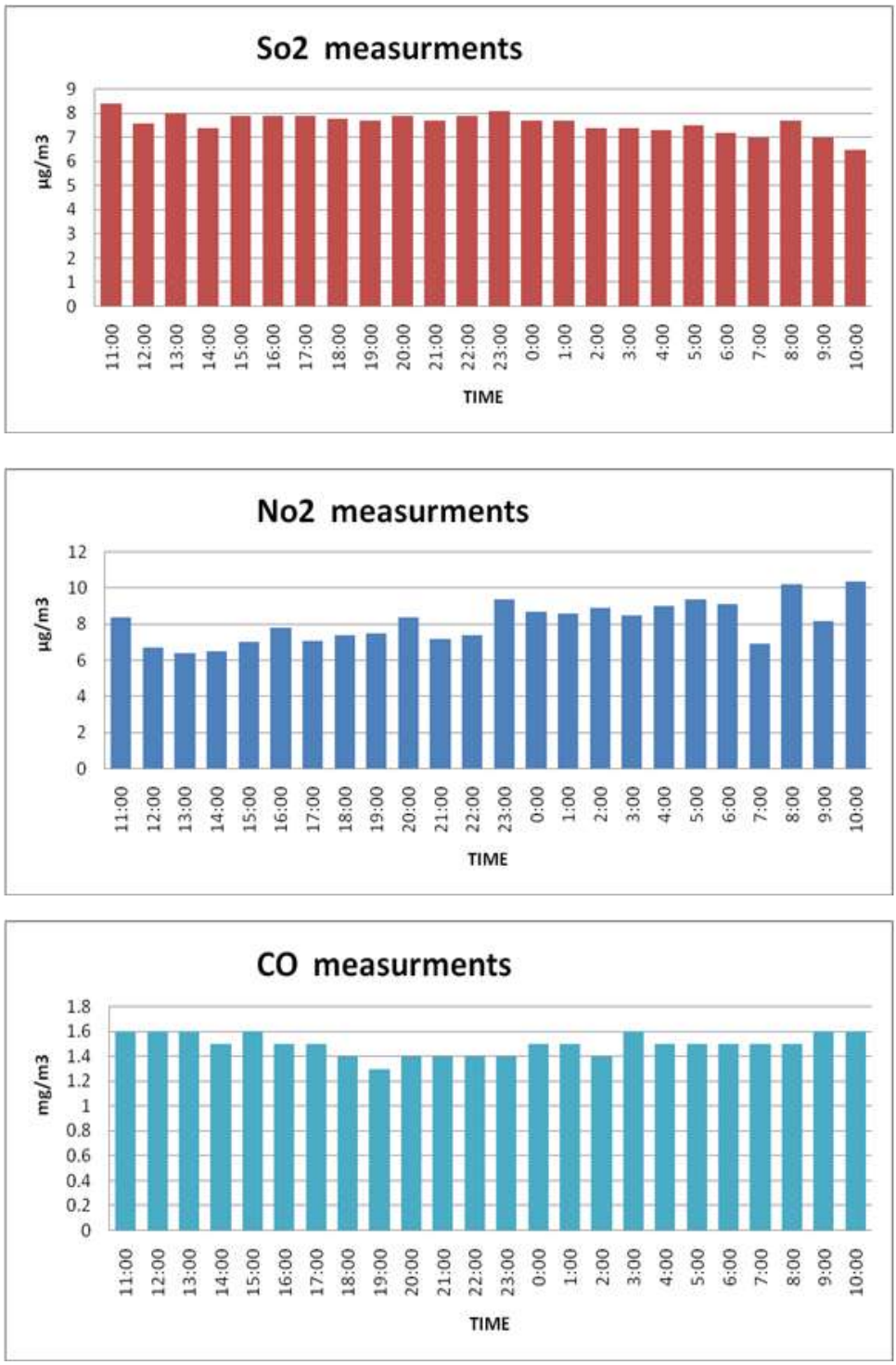


Table 5-7: 24 – hour Average Concentrations of Gases and Dust - Masurement Day 1

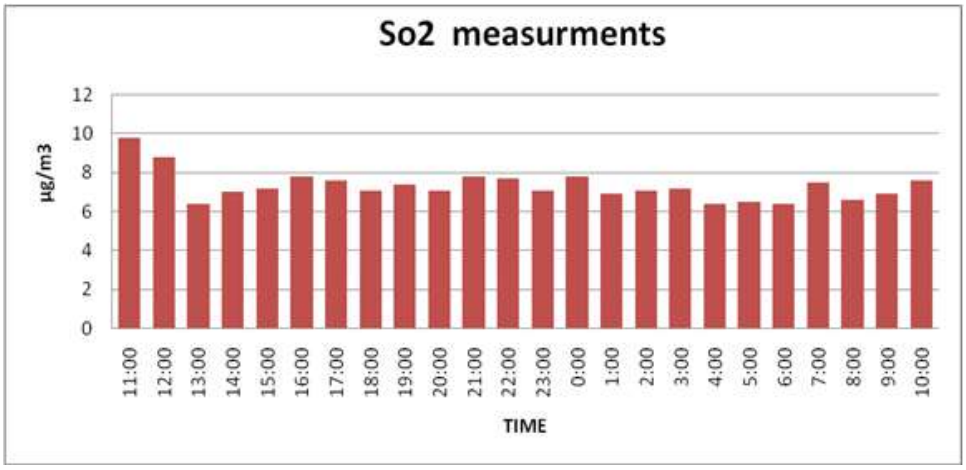
Pollutant	Concentration (mg/m³)	Limit Values
SO_2	7.61	125 (µg/m³)
NO_2	7.75	150 (µg/m³)
CO	1.5 mg/m3)	-
PM_{10}	25.6	150 (µg/m³)
TSP	53.4	230 (µg/m³)

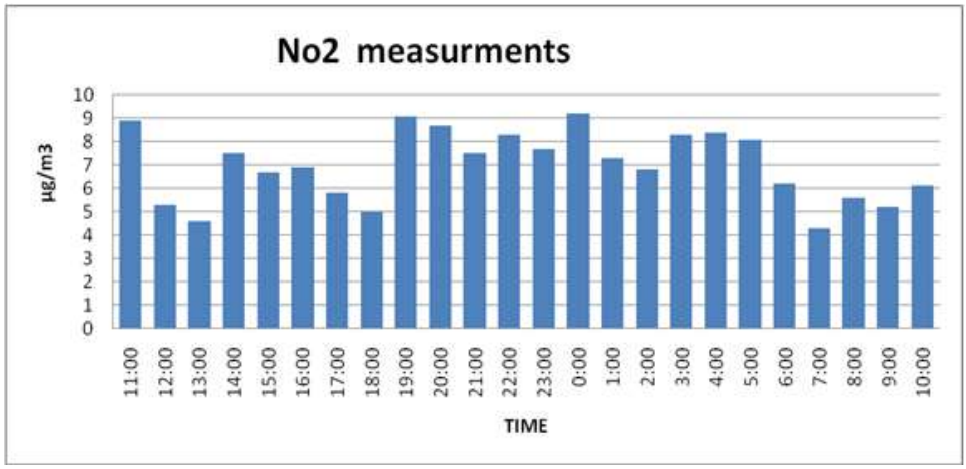
Day 2

Table 5-8: Hourly Concentrations of Gases / CO 8 H Average - Measurement Results for Day 2

Date	Time	SO_2 (mg/m³)	NO_2 (mg/m³)	CO (mg/m³)	CO 8h ave (mg/m³)
3/2/2020	11:00	9.8	8.9	1.5	1.45
	12:00	8.8	5.3	1.5	
	13:00	6.4	4.6	1.4	
	14:00	7	7.5	1.4	
	15:00	7.2	6.7	1.4	
	16:00	7.8	6.9	1.4	
	17:00	7.6	5.8	1.4	
	18:00	7.1	5	1.6	
	19:00	7.4	9.1	1.6	1.638
	20:00	7.1	8.7	1.6	
	21:00	7.8	7.5	1.6	
	22:00	7.7	8.3	1.6	
	23:00	7.1	7.7	1.7	
	24:00	7.8	9.2	1.7	
4/2/2020	01:00	6.9	7.3	1.6	
	02:00	7.1	6.8	1.7	
	03:00	7.2	8.3	1.6	1.563
	04:00	6.4	8.4	1.5	
	05:00	6.5	8.1	1.6	
	06:00	6.4	6.2	1.5	
	07:00	7.5	4.3	1.6	
	08:00	6.6	5.6	1.6	
	09:00	6.9	5.2	1.6	
	10:00	7.6	6.1	1.5	
Limit Values for 1h average		**300**	**300**	**30**	**10**

Figure 5-18 Day 2 Measurements





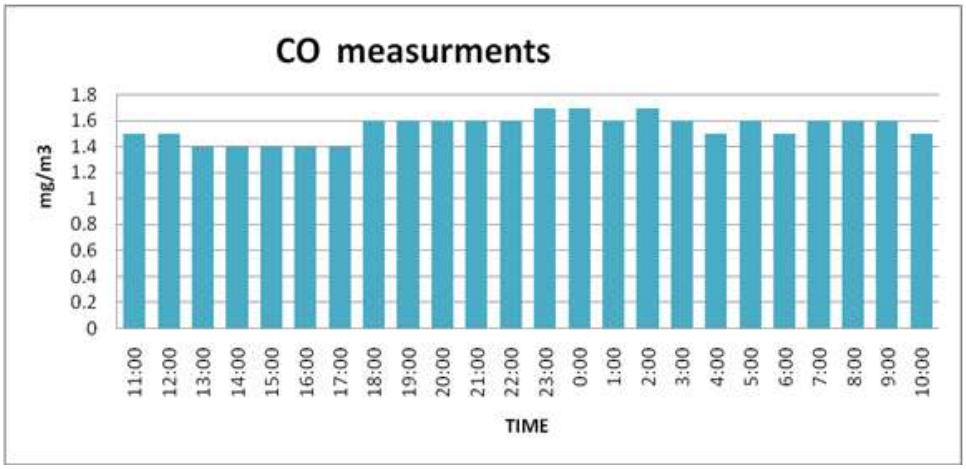


Table 5-9 24 -hour Average Concentrations of Gases and Dust - Measurement Day 2

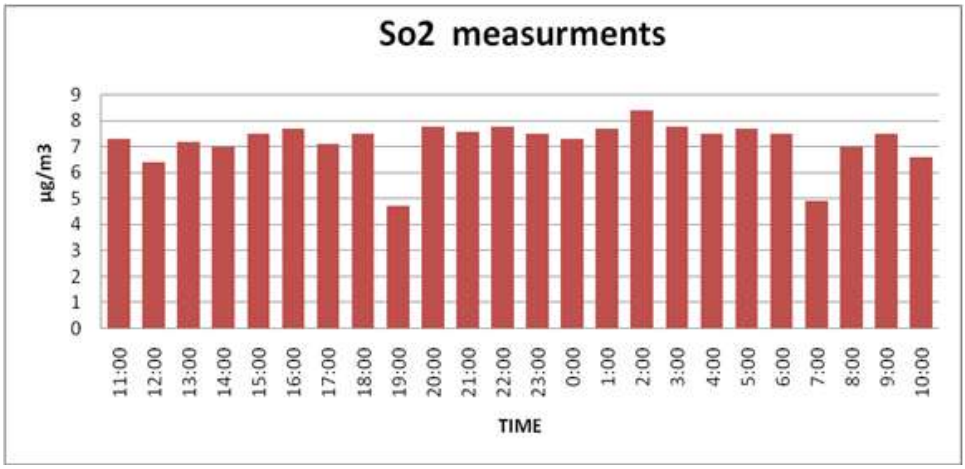
Pollutant	Concentration (mg/m³)	Limit Values
SO_2	7.32	125 (µg/m³)
NO_2	6.98	150 (µg/m³)
CO	1.55 (mg/m3)	-
PM10	29.8	150 (µg/m³)
TSP	56.4	230 (µg/m³)

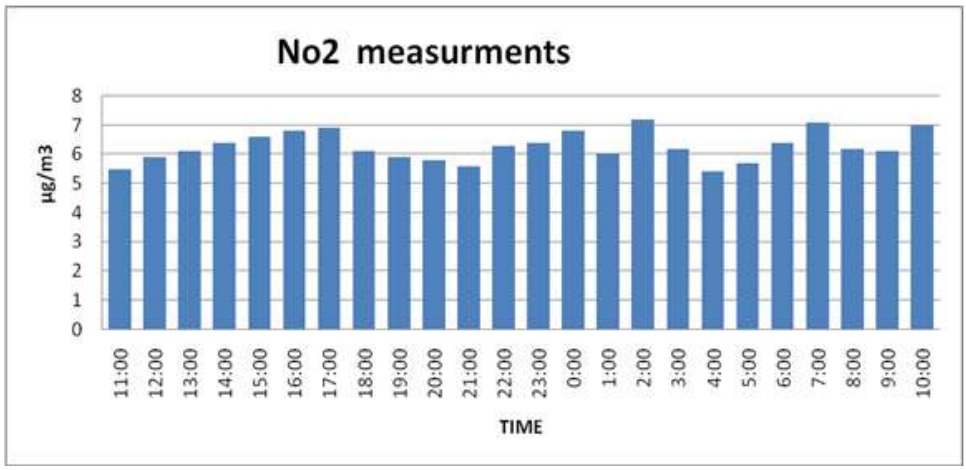
Day 3

Table 5-10 Hourly Concentrations of Gases/CO 8h average - Measurement Day 3

Date	Time	SO_2 (mg/m³)	NO_2 (mg/m³)	CO (mg/m³)	CO 8-h ave (mg/m³)
4/2/2020	11:00	7.3	5.5	1.2	1.338
	12:00	6.4	5.9	1.2	
	13:00	7.2	6.1	1.4	
	14:00	7	6.4	1.4	
	15:00	7.5	6.6	1.4	
	16:00	7.7	6.8	1.3	
	17:00	7.1	6.9	1.5	
	18:00	7.5	6.1	1.3	
	19:00	4.7	5.9	1.4	1.413
	20:00	7.8	5.8	1.4	
	21:00	7.6	5.6	1.4	
	22:00	7.8	6.3	1.5	
	23:00	7.5	6.4	1.3	
	24:00	7.3	6.8	1.5	
5/2/2020	01:00	7.7	6	1.4	
	02:00	8.4	7.2	1.4	
	03:00	7.8	6.2	1.9	1.475
	04:00	7.5	5.4	1.7	
	05:00	7.7	5.7	1.4	
	06:00	7.5	6.4	1.2	
	07:00	4.9	7.1	1.5	
	08:00	7	6.2	1.6	
	09:00	7.5	6.1	1.2	
	10:00	6.6	7	1.3	
Limit Values 1-h average		**300**	**300**	**30**	**10**

Figure 5-19 Measurements Day 3





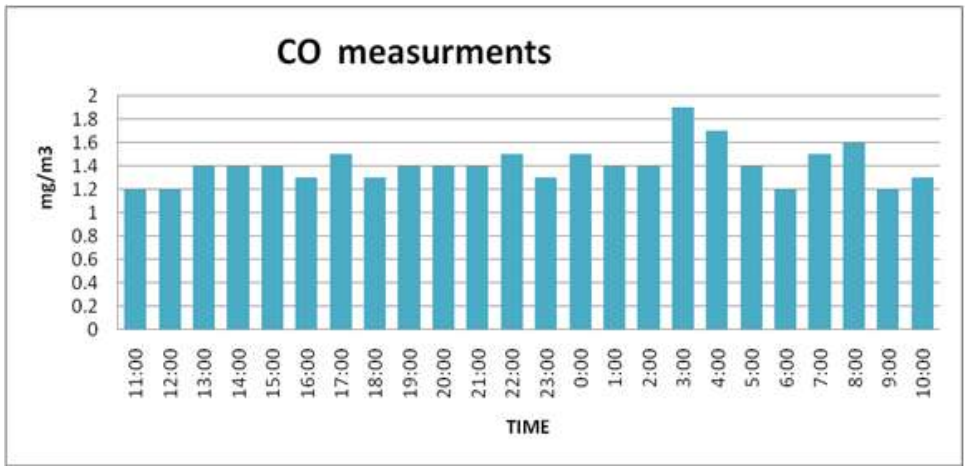


Table 5-11 24 -hour Average Concentrations of Gases and Dust - Measurement Day 3

POLLUTANT	CONCENTRATION (MG/M³)	LIMIT VALUES
SO_2	7.21	125 (µg/m³)
NO_2	6.27	150 (µg/m³)
CO	1.41 (mg/m3)	-
PM10	26.2	150 (µg/m³)
TSP	53.8	230 (µg/m³)

Ozone Measurements Results

Ozone has been measured in the same location 10 times at different times of day, resulting in the following values:

Table 5-12 Measurement Results for Ozone

DAY / MEASUREMENT	TIME			
Day 1	**9 am**	**1 pm**	**6 pm**	**10 pm**
Measurement, ppm	0.0001	0	0.0002	0
Day 2	**10 am**	**4 pm**	**11 pm**	
Measurement, ppm	0	0.00012	0	
Day 3	**11 am**	**5 pm**	**11 pm**	
Measurement, ppm	0.0003	0.0004	0	

Note: Ambient standards for 1h average: 180 µg/m³ ≡ 3.1ppbv =0.0031 ppmv

Summary of Monitoring Survey

The prevailing wind during the monitoring period was northerly. The wind speed reached a maximum of 19.2 km/h and the temperature reached approximately 24°C at 3 pm, whilst dropping to 15°C at 6 am.

The monitored hourly concentrations of sulphur dioxide, nitrogen dioxide and carbon monoxide are low compared to all limit values stated in the section above (including Egyptian, WHO and EU standards), for all averaging periods. PM_{10} and TSP concentrations also recoded levels below the Egyptian and WHO hourly standards. This indicates an airshed that is not heavily influenced by pollution sources, for which there were few sources locally.

A summary of peaks and low concentrations for SO_2, NO_2 and CO at the monitoring location are as shown in the following table. Ozone was also almost undetected.

Table 5-13 Summary of Ambient Air Measurements

PARAMETER	PEAK CONCENTRATION	LOWEST CONCENTRATION
Day 1		
SO_2	8.4	6.5
NO_2	10.4	6.4
CO	1.6	1.3
Day 2		
SO_2	9.8	6.4
NO_2	9.2	4.3
CO	1.7	1.4
Day 3		
SO_2	8.4	4.7
NO_2	7.2	5.4
CO	1.9	1.2

5.4 Sensitive Receptors

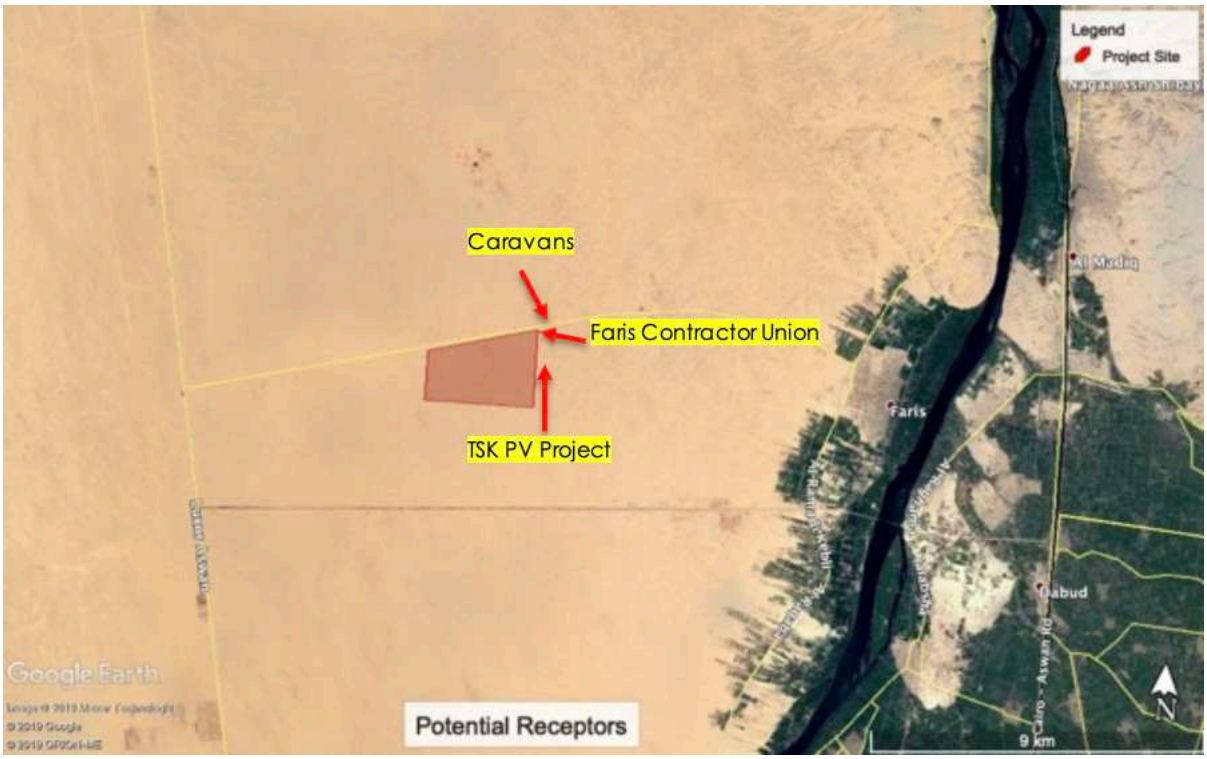
For air quality, the impact of air emissions will extend downwind of the site by the distance that emission plumes are likely to travel. Given the nature of the Project (Solar PV), air emissions are not expected to result from the operation of the plant, besides possible emergency diesel generator use. The impacts will therefore be primarily limited to the construction phase (i.e. dust generation, vehicle movements and temporary equipment use), therefore, the area of influence is likely to be within 1 km from the Project site. As a conservative approach and taking into consideration metrological conditions, the area of influence is extended to 3 km, which is considered large enough to account for any worse case scenarios and cumulative effects.

The locations of existing air sensitive receivers (ASR) in the Project Area were identified from available mapping and site inspection. The identified ASRs are detailed in Table 5-3 and shown in Figure 5-1. The sensitivity of the ASRs has been rated based on the criteria provided in Table 4-4 provided in Section 4 of this report. Receptors located more than 3 km away were not considered as sensitive receptors as discussed above. None of the receptors are located downwind from the Project site.

Table 5-14 Identified ASRs

RECEPTOR	SENSITIVITY	RECEPTOR TYPE	JUSTIFICATION	DISTANCE FROM PROJECT SITE
Faris Contractor Union	Medium	Human/ Commercial	This receptor is considered temporary, whether the workers relocate or stay once construction commences is unknown. However, most likely they will move out during the operational phase of the Project. If they are present during the construction phase, they are considered to have a medium sensitivity due to their close proximity to the Project site and habitation for periods of the day.	Approximately 100m from the north eastern corner of the Project Site.
TSK PV Project (under construction)	Medium	Industrial	Construction workers working on site might be vulnerable to changes in ambient air quality. They are considered to have medium sensitivity due to their close proximity to the Project site.	Located adjacent to Project site from the East.
Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	Industrial	As the TSK plant is nearing completion and most likely will be occupied by the O&M staff during the construction of the Kom Ombo Plant, the staff may be vulnerable to the changes in ambient air quality.	
Caravans (local contractors)	Medium	Commercial	Similar to the Faris Contractor Union receptors, this receptor is considered temporary, whether they relocate or stay once construction commences is unknown. Most likely they will relocate during the operational phase of the Project. If they are present during the construction phase, they are considered to have a medium sensitivity due to their proximity to the Project site and potential for humans to be present during periods of the day.	Across the road and approximately 150m north east of Project site

Figure 5-20 Identified ASRs



5.5 Potential Impacts, Mitigation, Management & Residual Impact

5.5.1 Construction Phase

During construction, local ambient air quality may potentially be affected by increased dust, particularly during the site preparation stage (site clearance, levelling of sand dunes areas and earthworks) and by the exhaust fumes of construction vehicles, equipment and temporary power generators. The typical air emissions resulting from these activities include: nitrogen oxides, sulphur dioxides, carbon monoxide, carbon dioxide, VOCs, particulates and BTEX.

The principal sources of dust, particulate and gaseous emissions during construction will be:

- Excavations and earthworks, such as ground breaking, cutting, filling and levelling;
- Vehicle movements on unpaved, or compacted surfaces;
- Particulate matter dispersion from uncovered truckloads;
- Vehicle and Construction equipment emissions (e.g. NOx, SO_2 and CO, CO_2, VOCs, particulates and BTEX) and particulates from vehicles, generators and other mechanical equipment;

- Stored VOCs and other volatile hazardous materials and;
- Odour from temporary wastewater facilities, or containment

Dust Generation

The principal sources of dust and particulate emissions during construction will be:

- Excavations and earthworks, such as ground breaking, cutting, filling and levelling;
- Vehicle movements on unpaved, or compacted surfaces; and
- Particulate dispersion from uncovered truckloads.

Dust Emissions from Site Preparation

Dust resulting from excavations and earthworks typically comprises large diameter particles, which settle rapidly and close to the generation source.

According to the screening guidance of the UK's Institute of Air Quality Management (IAQM) for construction dust, detailed assessment relating to dust generation is required where there is a 'human receptor' within 350m of the boundary of the site. In the instance of this Project and with respect to the screening criteria above, all receptors identified above (i.e. Faris Contractors Union, Local Contractors and workers from adjacent TSK PV Project) are within 350m of the project site boundary. As such, there is the potential for impacts relating to dust emissions as a result of site preparatory activities upon these receptors.

However, the magnitude of such dust impacts from site preparatory works will depend on the wind speed and wind direction at the Project site which have been observed to predominantly come from the north westerly direction. None of the receptors are located down-wind.

Dust Emissions and Particulate Emissions from Movement of Vehicles

In addition to vehicle movements on unpaved surfaces, dust generation from truck movements and particulate dispersion from uncovered truckloads would only occur where mitigation measures are not effectively implemented at the site, or by contractors bringing materials to the site.

Uncontained and/or un-sheeted trucks may be subject to losses of material where the containment is not effective (e.g. spills), or where wind or other air turbulence may disturb the contents and result in dispersion of materials. Such impacts have the potential to degrade local air quality in the immediate area of such movements.

In accordance with the UK's IAQM Guidance on the Assessment of Dust from Demolition and Construction, detailed assessment of vehicle movements should only be required where 'human' receptors are located within 50m of the route used by construction vehicles on public roads, up to 500m from the project site entrance. For the Kom Ombo PV Power Project, the receptors within 50m of the route to be used by construction vehicles are the Faris Union

Contractors and Local Contractors located across the road from the site. As such there is the potential for impacts relating to dust generation or particulate emissions as a result of increase vehicle movement on this route.

Gaseous Emissions

The principle sources of gaseous emissions to air during construction will be the combustion of fossil fuels from the operation of vehicles, construction equipment and plant. Such vehicles and equipment are likely to include, but not be limited excavators, graders, pavers, cranes, vibratory rollers, generators, etc. The quantity of gaseous emissions from this equipment will depend on the numbers deployed on site and the hours of operation; but they are expected to be relatively few in number with respect to the geographic extent of the project site. Any emissions from construction vehicles, plant and equipment are expected to mix in ambient air close to the point of origin and are unlikely to be discernible thereby resulting in emissions that are not distinguishable from the background concentrations or emissions that will not result in an exceedance in ambient air quality standards/concentration. However, where old or poorly maintained equipment is operated, there is potential for noticeable and/or cumulative impacts to occur. Such impacts are not expected to be discernible at receptor locations over 500m from the project boundary and over 50m from the site access road.

Volatile Organic Compounds (VOC's)

Small quantity of fuels, paints, solvents and other volatile substances are likely to be required during the construction phase, which will be stored in secure areas within the construction laydown areas. If not adequately contained, such substances have the potential to result in the dispersion of volatile emissions to the immediate air shed. Given that the likely storage of such volatile substances will be in small volumes, such impacts will be limited to the immediate surrounding area of the Project boundary. Impacts may occur to areas immediately outside of the site such as the adjacent TSK PV Power Plant, where inappropriate storage or use of substances is in close proximity to the construction site boundaries.

Odours

The construction phase of the project will likely include a number of toilet facilities on site for site staff and construction workers. There is the potential for release of odour to the immediate surrounding areas associated with inappropriate containment and coverage associated with wastewater holding/septic tanks. However, such impacts are likely to be temporary, negligible and limited to the immediate surrounding area such as the adjacent TSK PV Power Plant. As human receptors are located at greater distance from the Project boundary, Odour is not expected to be discernible at these locations.

Table 5-15 Air Quality Impact Significance, Mitigation & Management Measures and Residual Impacts – Construction

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impact
Dust emissions within 500m of the project boundary – Generated as a result of site preparatory works and movement of vehicles on unpaved surfaces	**Minor Negative**	Faris Contractor Union	Medium	**Minor**	• Any land grading, excavations and moving of uncovered waste/materials should be undertaken during periods of low winds (e.g. <15 km/h is recommended as a threshold when a review of works is conducted). • Vehicle speeds on all site roads will be restricted to 20km/h. • Where sand and other dusty materials are transported to the site, trucks will not be overloaded and will be appropriately covered / sheeted to avoid loses en-route. • Cement and other fine powders should be sealed or covered after use, stored and transported in enclosed or bunded containers. • Dusty material stockpiles (i.e. any fine sands and powders) dust generating activities (stone cutting) are to be located away from the site boundaries and be contained or covered with suitable netting to avoid dust dispersion during storage or use. • Vehicle routes will be clearly demarcated and appropriate signage displayed around the site. • Wetting down of any unpaved site roads in order to reduce dust generation. • The provision of a wheel-washing facilities or high-pressure hose to ensure all vehicles leaving the site are in a satisfactory state of cleanliness. • No burning of wastes will be allowed onsite.	**Negligible to Minor**
	Minor Negative	TSK PV Project (under construction)	Medium	**Minor**		**Negligible to Minor**
	Minor Negative	Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	**Minor**		**Negligible to Minor**
	Minor Negative	Caravans (local contractors)	Medium	**Minor**		**Negligible to Minor**
Gaseous Emissions – From exhaust of vehicles	**Minor Negative**	Faris Contractor Union	Medium	**Minor**	• Construction roads in the site will be designated and made clear to the drivers with signage for directions and speed limits placed all along the roads. • Internal roads inside the project site will be compacted as it reduces vehicular power consumption • Unnecessary usage of vehicles, plant and equipment will be minimised - No unnecessary idling.	**Negligible to Minor**
	Minor Negative	TSK PV Project (under construction)	Medium	**Minor**		**Negligible to Minor**
	Minor Negative	Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	**Minor**		**Negligible to Minor**

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impact
	Minor Negative	Caravans (local contractors)	Medium	**Minor**	• Deliveries of equipment/plant to the site will be efficiently managed to reduce the number of trips. • Exhaust fumes and particulates emitted from trucks and vehicles will be minimised by ensuring the use of good condition vehicles (e.g. compliant to vehicle emission requirements). • There should be pre-requisite requirements of site vehicles to ensure no black smoke before entering site and that any identified machinery or vehicles with black smoke will require maintenance and re-assessment before it is returned. • Lorries and truck engines will be turned off while waiting on site to minimize gaseous emissions. Air-conditioned or heated shelters should be provided for drivers in designated waiting, loading and unloading areas to prevent drivers waiting in vehicles. • Emissions from machinery and equipment should be free from significant black smoke.	**Negligible to Minor**
Emission of VOCs and other hazardous volatiles	**Negligible Negative**	Faris Contractor Union	Medium	**Negligible to Minor**	• Hazardous materials stored and used on site with potential gas emissions (e.g. Volatile Organic Compounds) will be located in well-ventilated, but secure low-risk areas, away from major transport routes and away from the site boundary (where possible). • Volatile fuels and chemicals (including hazardous wastes) will be stored in sealed containers. On site storage of large quantities of volatile fuels will be avoided, equally prolonged exposure to direct sun and heat will be avoided. • Fires and material burning will not be allowed on the Project site. • Chemical storage areas will be purpose built and well maintained. A data log of all chemicals with MSDSs will be provided at the storage facility within easy access.	**Negligible**
	Negligible Negative	TSK PV Project (under construction)	Medium	**Negligible to Minor**		**Negligible**
	Negligible Negative	Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	**Negligible to Minor**		**Negligible**

5.5.2 Operation Phase

The proposed project is associated with the generation of renewable energy, hence there are no permanent (on-going) fuel combustion requirements or any other associated air emissions directly from the PV Plant. An emergency diesel generator will be supplied to provide power in case of malfunctioning or disconnection from the grid, however this will not be used except for in emergency situations only (which feasibly may not occur). As such, no specific air pollution emissions sources other than those from the operation of vehicles are anticipated during the operational phase of the Project. Emergency diesel generator(s) shall be provided to maintain safe auxiliary power supply in case of blackout conditions (including the required control and monitoring facilities and the Central Control Room).

Operational Vehicle Emissions

The facility is likely to result in the small additional number of commuter vehicles and delivery/removal vehicles along access roads. Emissions from these vehicles will unlikely result in a noticeable impact above the existing vehicular emissions from the surrounding roads in the area, as such detailed assessment has not been conducted.

Table 5-16 Air Quality Impact Significance, Mitigation & Management Measures and Residual Impacts - Operation

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impact
Gaseous Emissions from Vehicles and emergency diesel generator	**Negligible Negative**	Faris Contractor Union	Medium	**Negligible to Minor**	• Appropriate quality of fuel used - Fuel of an internationally compliant standard to be sourced through a licensed supplier. • Limit unnecessary usage of vehicles - No unnecessary idling. • Planned inspection and maintenance of project vehicles and mobile equipment will be undertaken annually to ensure worthiness. • Emissions from vehicles should be free from significant black smoke - remedial measures shall be taken if this is observed. • Implement regular maintenance program of vehicles, and keep documentary evidence.	**Negligible**
	Negligible Negative	TSK PV Project (under construction)	Medium	**Negligible to Minor**		**Negligible**
	Negligible Negative	Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	**Negligible to Minor**		**Negligible**
	Negligible Negative	Caravans (local contractors)	Medium	**Negligible to Minor**		**Negligible**

5.6 Monitoring

The EPC Contractor and the O&M Company will undertake air quality monitoring during both the construction and operational phases of the project respectively and these are outlined in the table below. The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan'.

Table 5-17 Air Quality Monitoring Requirements

MONITORING	PARAMETER	FREQUENCY & DURATIONS	MONITORING LOCATION
Construction			
Dust Generation & Dispersion	Dust	Visual observation for dust emissions to be undertaken on a daily basis. To be monitored quantitatively if generation is considered to be excessive or complaints are received.	Access Road to the Project site, Construction site and laydown areas Dispersion to external receptors from point of generation.
Emissions from engines	Vehicle Emissions	Visual assessment of emissions to be undertaken on a daily basis while vehicles and equipment are in use and annual inspection of vehicles. This would include an inspection during the initial acceptance criteria of such vehicles to site.	All non-road vehicles and engines
Sanitary Facilities & Hazardous stores	Odour & VOCs	Daily olfactory observations – as part of maintenance and inspection checks	All sanitary facilities available within the laydown areas, sub-contractor camps and work fields. All hazardous material, chemical and fuel stores.
Operation			
Emissions from engines	Vehicle & emergency generator emissions	Regular maintenance & servicing of project vehicles and planned annual inspection.	All road and non-road vehicles and engines

6 NOISE AND VIBRATION

6.1 Introduction

This chapter assesses the potential noise impacts and effects that may occur as a result of the projects construction operational activities and identifies the measures that will be undertaken and implemented in order to mitigate these impacts.

6.2 Standards and Regulatory Requirements

6.2.1 National Standards

Annex 7 (Table 4) of the Ministerial Decree 338/1995 amended in 2005 on promulgating the Executive Regulations of the Environmental Law No. 4 of 1994 sets out the maximum permissible noise levels for different receptor types.

Table 6-1 Maximum Permissible Limit for Noise Intensity in Different Areas

RECEPTOR CLASSIFICATION	PERMISSIBLE LIMIT FOR NOISE INTENSITY DB(A)		
	DAY (7AM TO 6PM)	EVENING (6PM TO 10PM)	NIGHT (10PM TO 7AM)
Residential rural areas, hospitals and gardens	45	40	35
Residential suburbs with low traffic	50	45	40
Residential areas in the city	55	50	45
Residential areas in which can be found some workshops or commercial establishments or which are located on a main road	60	55	50
Commercial, administrative and downtown areas	65	60	55
Industrial areas (heavy industries)	70	65	60

The table below provides standards for the maximum permissible noise levels inside the workplace.

Table 6-2 Maximum Permissible Noise Levels inside the Workplace

Type of Place and Activity	Maximum Permissible Noise [level equivalent to dB(A)] (L_{Aeq})
Work place with up to 8-hour shifts and aiming to limit noise hazards on sense of hearing	90
Work place where acoustic signals and good audibility are required	80
Work rooms for computers, typewriters or similar equipment	70
Work rooms for the follow up, measurement and adjustment of high-performance operations	65
Work rooms for activities requiring routine mental concentration	60

6.2.2 Lenders Requirements

AFDB

AFDB OS requirements necessitate compliance with the World Bank Group EHS Guidelines (see below).

IFC/WHO Requirement

Financial institutions are likely to require adherence to WHO noise standards as detailed in IFC EHS Guidelines, which stipulate a maximum threshold of 70dB(A) at industrial or commercial receptors during daytime.

Table 6-3 World Bank Ambient Noise Level Guidelines

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime (7am-10pm)	Night (10pm-7am)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70
Guideline values are for noise levels measured out of doors.		

Source: World Bank EHS General Guidelines, 2007.

These relate to the most sensitive point of reception and not the plant boundary. Noise impacts should not exceed the levels presented above, or result in a maximum increase in background levels of 3 (dBA) at the nearest sensitive receptor location off-site.

European (EBRD) Standards

The European Commission Environmental Noise Directive (Directive 2002/49/EC) relating to the assessment and management of environmental noise is the main EU instrument to identify noise pollution levels and to trigger the necessary action both at Member State and at EU level. The Directive applies to noise to which humans are exposed, particularly in built-up areas,

in public parks or other quiet areas in an agglomeration, in quiet areas in open country, near schools, hospitals and other noise-sensitive buildings and areas. It is important to note, however, that the Directive does not set limit or target values, nor does it prescribe the measures to be included in the action plans, thus leaving those issues at the discretion of the competent Member State authorities.

6.3 Baseline

The main sources of noise at the Project area are from the construction activities ongoing at the adjacent TSK PV Power Plant. Noise from vehicles along the road bordering the site from the north does not pose as a major source of noise. Traffic flow at this road recorded low traffic during the baseline survey conducted for the Project.

In order to establish the current noise levels at the Project site and surrounding area, a baseline noise survey was conducted on the 1st of February 2020 at four (4) locations at the Project site and two (2) at receptor locations (within two (2) km of the Project site). The noise monitoring locations are illustrated in the figure below and presented in the following table.

Figure 6-1 Noise Monitoring Locations

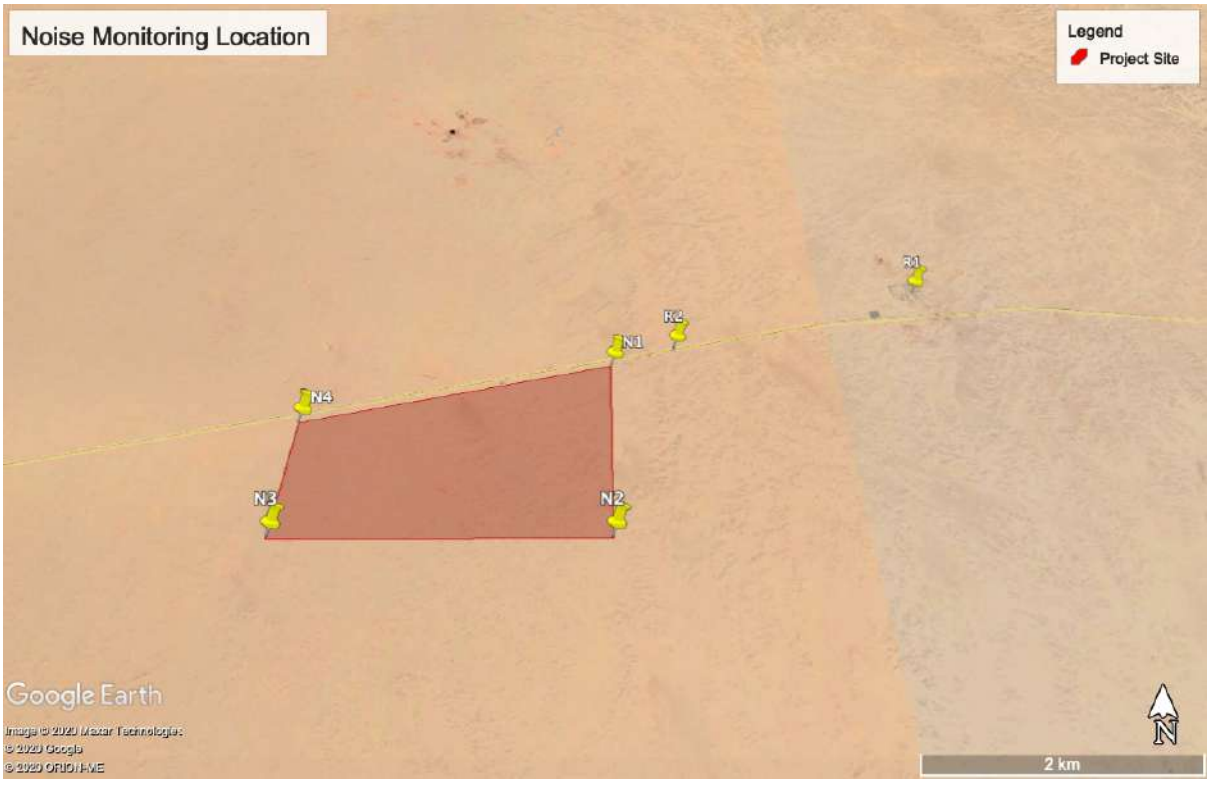


Table 6-4 Coordinates of Noise Monitoring Locations

Degrees Minutes & Seconds (DMS)			
		Northing	Easting
	N1	24°37'25.06"	32°48'33.19"

Degrees Minutes & Seconds (DMS)			
		Northing	Easting
Site Boundaries Measurement Locations	N2	24°36'17.43"	32°48'33.29"
	N3	24°36'17.42"	32°46'49.69"
	N4	24°37'0.50"	32°46'49.69"
Noise Receivers Measurements Locations	R1 (New Faris Village)	24°38'0.78"	32°50'26.34"
	R2 (Local Contractors)	24°37'32.96"	32°48'55.42"

Methodology

The main objective of the noise survey was to establish the background noise levels at the Project site and sensitive receptors and to compare the recorded noise levels with ambient noise standards stipulated by the EEAA and WB EHS General Guidelines/WHO.

The noise survey was carried out using -held Analyzer Types 2250 by B&k (Calibration certificate provided in **Appendix F**). Results were logged for LAFmax, LAFmin, LCpeak, LAleq, LAeq, LCeq, LAF1.0, LAF5.0, LAF10.0, LAF50.0, LAF90.0, LAF95.0, and LAF99.0. Noise measurements were taken for 1-hour continuously at each receptor location and 15-minutes at each project/boundary location during day time and night time periods. A windshield was attached to the sound level meter throughout the measurements' duration which reduces the effects of wind and air movement across the microphone and diminishes their influence on the precision of the measurements.

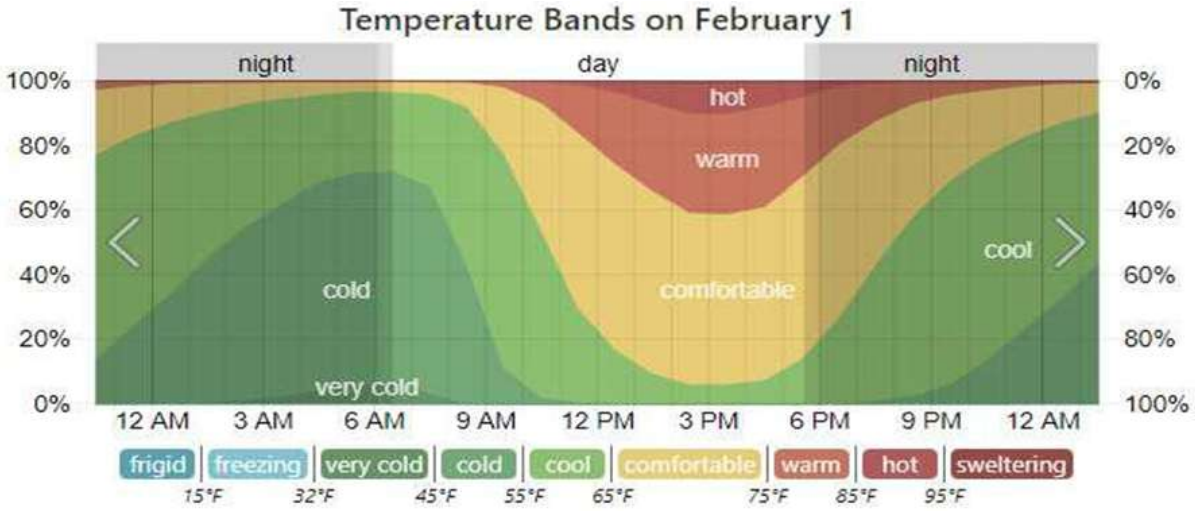
Meteorological Conditions

The meteorological conditions were recorded during the period of data collection and noise measurement. Overview of the conditions are presented in the Table below.

Table 6-5 Meteorological Conditions in Aswan on February 1st 2020

Metrological Conditions	
Clouds	During the measurements Aswan had clear, mostly clear, or partly cloudy conditions for 82% of the day
Sun	The sunrise on February 1st,2020 in Aswan was at 6:29 AM and the sunset was at 5:34 PM
Humidity	The weather was dry throughout the day.
Wind Speed	The average hourly wind speed varied throughout the day, with a daily average of 8.8 miles per hour
Wind Direction	The hourly average wind direction, in order of prevalence, is from the north (79%), west (11%), east (8%), and south (2%)
Temperature	Figure below shows a compact characterization of the range of temperatures experienced on February 1st, 2020. The horizontal axis is the time of day and the colored stacked areas indicate the percentage of hours spent in various temperature bands

Figure 6-2 Temperature Bands on February 1st 2020



The noise levels obtained within and outside the project site (at receptor location) are presented in the table below.

Table 6-6 Noise Monitoring Results

ID	MEASURED NOISE LEVEL DB(A)			EGYPTIAN STANDARD	WHO STANDARDS	OBSERVATIONS
	L-MIN	L-MAX	LEQ			
Day Time						
N1	29.3	75.5	56.2	60 dB(A)	70 dB(A)	Construction noise from TSK PV site approximately 100 m north east of monitoring location. Two (2) speeding cars were recorded during the period of the monitoring.
N2	25.5	60.9	40.7			No major noise sources were observed, only the passage of two cars on the main road. Construction activity was taking place at TSK PV site. It was observed that traffic and construction activities had a minor effect on noise level in this location.
N3	26.3	60.9	40.2			No major noise sources were observed.
N4	25.0	65.5	45.2			Noise from vehicles passing from the nearby road (north of monitoring location).
R1	20.6	65.9	49.0			The abandoned village has nearly no activity; only 2 to 5 cars passing by on the road on average (for the duration of the monitoring). Construction activities were on going 600 m from the monitoring location.
R2	46.4	76.2	60.7			Construction works was ongoing during the measurement period. Many workers were moving around the site during the time of the measurements.
Night Time						
N1	34.2	64.7	43.6	70 dB(A)	70 dB(A)	One (1) motorbike was recorded during the monitoring period.

ID	MEASURED NOISE LEVEL DB(A)			EGYPTIAN STANDARD	WHO STANDARDS	OBSERVATIONS
	L-MIN	L-MAX	LEQ			
N2	34.4	71.5	58.2			One 1 or 2 motorbikes were recorded during the monitoring period.
N3	34.2	75.0	58.9			One 1 or 2 motorbikes were recorded during the monitoring period.
N4	33.0	54.8	43.7			One motorbike was recorded during the monitoring period.
R1	23.7	56.0	32.9			TBP
R2	34.9	75.6	55.3			TBP

TBP: To be provided by EDG (local consultant) and awaiting clarification from EDG on noise measurements

The noise levels obtained during the day and night time surveys were all below the Egyptian and IFC/WB noise standards for industrial areas. During the day time, the noise results were mainly influenced by the construction activities on going at the adjacent TSK PV Plant site and low traffic movement occurring at the time of the survey.

6.4 Sensitive Receptors

In relation to noise impacts, the expected range of impacts (area of influence) is likely to be around the Project site within a zone of 2 km. This is due to noise attenuation by distance propagation, hence decreasing in magnitude with increased distance from the source. Also, topographical features, surface coverage and buildings influence how sound is transmitted through the air.

The nature of noise as a pressure wave dictates that with distance, noise prorogation will result in losses of energy and ultimately a decrease in the noise level observed at the point of reception. In addition, when noises are combined or considered in combination, the predominant noise will primarily be evident over lower magnitude noises.

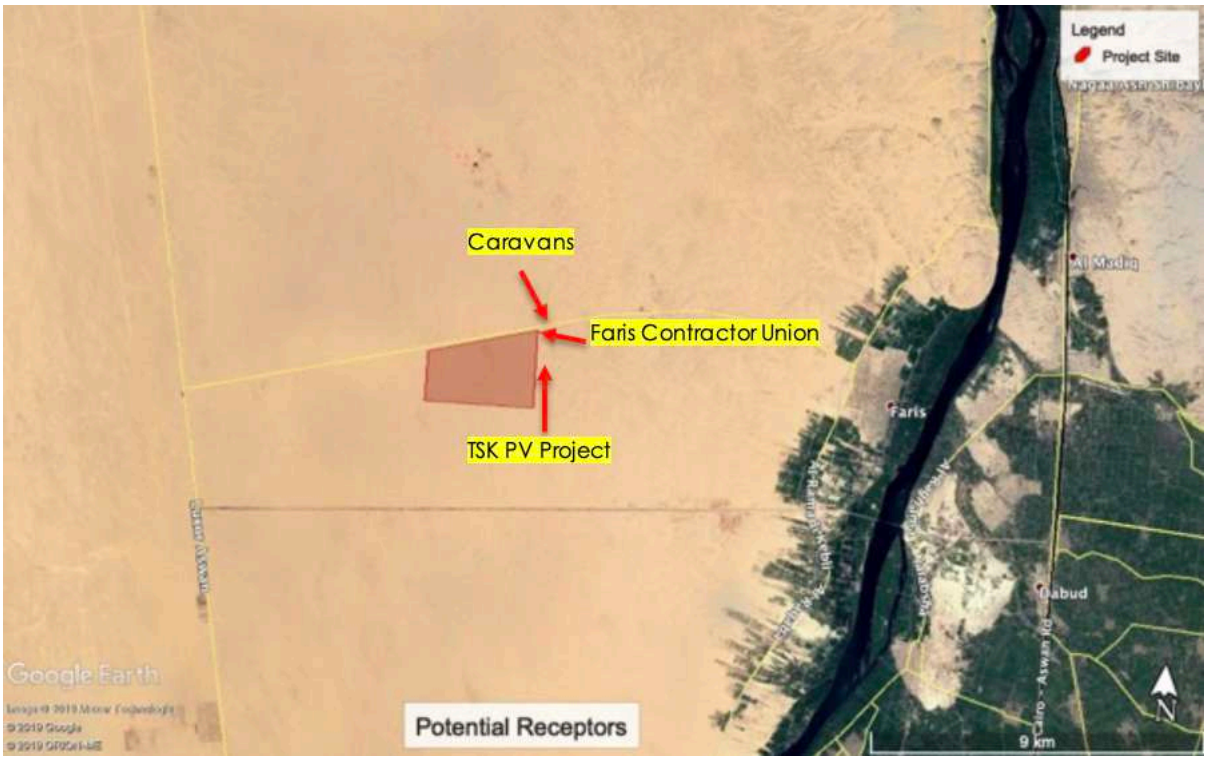
The locations of the sensitive receptors were identified from review of satellite imagery and site visits conducted in December 2019 and February 2020. The potential sensitive receptors to noise are similar to the air quality receptors, as set out below.

Table 6-7 Noise Sensitive Receptors

RECEPTOR	SENSITIVITY	RECEPTOR TYPE	JUSTIFICATION	DISTANCE FROM PROJECT SITE
Faris Contractor Union	Medium	Human/ Commercial	This receptor is considered temporary, whether the workers relocate or stay once construction commences is unknown. However, most likely they will move out during the	Approximately 100m from the north eastern corner of the Project Site.

Receptor	Sensitivity	Receptor Type	Justification	Distance from Project Site
			operational phase of the Project. If they are present during the construction phase, they are considered to have a medium sensitivity due to their close proximity to the Project site and habitation for periods of the day.	
TSK PV Project (under construction)	Medium	Industrial	Construction workers working on site might be vulnerable to changes in noise, but will already be impacts by noise from the TSK construction site.	Located adjacent to Project site from the East.
Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	Industrial	As the TSK plant is nearing completion and most likely will be occupied by the O&M staff during the construction of the Kom Ombo Plant, the staff may be vulnerable to the changes in noise due to the quiet nature of their operational PV Project.	
Caravans (local contractors)	Medium	Commercial	Similar to the Faris Contractor Union receptors, this receptor is considered temporary, whether they relocate or stay once construction commences is unknown. Most likely they will relocate during the operational phase of the Project. If they are present during the construction phase, they are considered to have a medium sensitivity due to their proximity to the Project site and potential for humans to be present during periods of the day.	Across the road and approximately 150m north east of Project site

Figure 6-3 Noise Sensitive Receptors



6.5 Potential Impacts, Mitigation, Management & Residual Impact

6.5.1 Construction Phase

Construction Site Noise

Construction activities will likely result in temporary and short duration increases in the noise and vibration levels emanating from the project site, access road and the laydown areas; dependent on the type of works being undertaken.

Noise will be generated by construction and propagated to the surrounding areas via a range of processes. Pertinent construction activities at the project site in relation to noise are likely to include

- Site Preparation (e.g. earthworks, compaction);
- Civil Works (e.g. piling);
- Construction and Installation;
- Internal Road Paving/Compacting; and
- Vehicle movements.

The accumulation of noise from the above sources can introduce potential cumulative impacts when generated in tandem. All of these impacts may have a negative effect on the amenity of receptors within 2 km of the Project site.

The anticipated construction equipment/machinery to be used at the site for various construction activities together with noise data for this equipment are presented in the table below as obtained from 'British Standards: Code of practice for noise and vibration on construction and open sites.

Table 6-8 Noise Level of Typical Construction Equipment

Construction Activities	BS 5228-1:2009 Reference	Equipment	SPL dB (A)
Site clearance	Table C.2, 4	Tracked Excavator (22t)	52
Earthworks	Table C.2, 13	Dozer (11t)	78
	Table C.2, 20	Tracked Excavator (25t)	68
	Table C.6, 28	Wheeled Loader	76
Material Handling	C.2, 30	Dump truck (29t)	79
	C.2, 38	Roller (18t)	79
	C.2, 40	Vibratory Roller (3t)	73
	C.2, 42	Hydraulic compactor	78
	C.4, 20	Concrete mixer truck	80
	C.4, 22	Concrete mixer (26t)	76
	C.4, 41	Mobile Crane (100t)	71
Stationary	C.4, 84	Diesel generator	74
Road construction	C.5, 1	Hydraulic breaker (67kw)	88
	C.5, 32	Asphalt paver (18t)	84

The accumulation of noise from the above activities can introduce potential impacts at receptor locations. Under assumed worst-case circumstances where all equipment is operating at the at the same location for 50% of the working day, the combined cumulative noise level perceived at a distance of 10m distance from the source would be 88.5dB(A). This is considered to be a worst case for noise during construction, as it is not expected that this equipment will be located in the same area and operational concurrently.

As noise levels dissipate with distance, the potential for noise impacts at receptor locations will decrease with increase in distance from the noise source. By using calculations set out in BS5228:2009 (Part 1), it is possible to predict expected noise levels at this location. This has been presented below with adjusted noise levels form the Projects construction accounted for with distance attenuation.

Table 6-9 Summary of Construction Site Noise Assessment

Receptor	Baseline Noise Level (dBA) (Morning)	Distance from Source (m)	Anticipated Construction Noise at Receptor Location Due to Construction Works & distance attenuation (dBA)	Cumulative Noise Level at Receptor Location (dBA)
Faris Contractor Union (noise measurement closest to this receptor – N1)	56.2	100	65.5	66.0

Receptor	Baseline Noise Level (dBA) (Morning)	Distance from Source (m)	Anticipated Construction Noise at Receptor Location Due to Construction Works & distance attenuation (dBA)	Cumulative Noise Level at Receptor Location (dBA)
TSK PV Project (under construction) (noise measurement closest to this receptor -N1)	56.2	10	88.5	**88.5**
Future Staff (O&M) of TSK PV Plant (Once operational – N1)				
Caravans (local contractors) (noise measurement closest to this receptor – R2)	60.7	150	61.1	63.9

The calculated noise level may exceed the Egyptian and WHO/IFC noise standard for industrial areas at the TSK PV Project impacting the construction workers on site if the construction periods coincide for both Projects. If not, the future O&M staff for the TSK PV project may be impacted for a limited time (temporary) from the construction activities. It should be noted that the calculations assumed worst-case circumstances where all equipment are operating at 100%. In addition, the above calculations do not account for any acoustic barriers between the noise source and the sensitive receptors. The buildings, acoustic enclosures and fence line of Project and the receptor will act as an acoustic barrier and will reduce the noise impact on the receptor. Therefore, the noise levels from the Project at the receptor is expected to be less than the calculated value.

Other receptors outside the area of influence (more than 2 km), such as the New Faris Village (Closest residential area), located more than 3 km away, are extremely unlikely to be impacted by the construction and operation of the Project. Therefore, the development of the Project will not contribute to the background noise at this receptor.

Construction Vehicle Noise

The addition of temporary construction vehicles on Project access roads (i.e. external road network) and within the site will likely result in temporary increases in traffic which will consequently result in an increase to noise levels at off-site receptors, particularly those immediately adjacent to the Project, with reduced impacts at receptors within 1km to the Project boundary, and close to the site access roads (i.e. Faris Contractors Union and Local Contractors across the road (Caravans)). Impacts due to vehicular noise will vary due to the phasing of works and the timing of vehicular movements, which affect both vehicle flows and the percentage of heavy vehicles.

The transport route to the site will be through the road bordering the site from the North (i.e. Faris – Luxor road 1) which most likely will be accessed through Luxor – Aswan road and/or Al

Ramadi Kebli – Al Raqaba road located approximately 6.5 and 8.4 to the west and east of the project site.

The construction of the Project might lead to a small increase of existing vehicle flows along the road resulting in a noticeable traffic impact or secondary noise impacts to road users and any receptors in close proximity to the road. All receptors are located very close to the road that will be used by the construction vehicles to access the Project site. This may result in minor increases in noise at these receptor locations.

Vibration

Certain construction processes, particularly those involved with site preparation and civil works, e.g. breaking, piling, vibratory rollers etc. have the potential to create vibration within the vicinity of the works. Vibration is also anticipated to occur sporadically around the construction site due to the movement of materials and equipment. However, it should be noted that vibrations dissipate rapidly as they spread due to losses of energy radiating 360 degrees from the source.

As such, vibratory impacts as a result of the Project construction activities are only anticipated to be negligible at the project boundaries and at the receptors adjacent to the project site (i.e Faris Contractors Union and TSK PV Power Plant).

Table 6-10 Noise and Vibration Impact Significance, Mitigation & Management Measures and Residual Impacts – Construction

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impact
Construction Site Noise – Noise generated from general construction activities	**Minor**	Faris Contractor Union	Medium	**Minor**	• Acoustic covers on machine engines to remain closed at all times. • The Contractor will, at all times, carry out all work in such a manner as to keep any disturbance from noise to a minimum (by phasing noisy works). • Vehicles/equipment will be operated within manufacturer recommended guidelines so as to avoid causing excessive noise. • Where practical, electrically powered plant will be preferred to mechanically powered alternatives. • All mechanically powered plant, diesel engine vehicles and compression equipment will be fitted with noise control equipment (exhaust silencers, mufflers) as available from the manufacturer. • Where possible, the highest noise emitting activities should be undertaken in a central site area and away from boundaries. • Where appropriate, noise barriers /attenuation to be employed (e.g. for generators) to ensure that the maximum noise level at 1 m distance from a single source will not exceed 85 dB(A). • Where noise levels exceeds 85 dB(A) noise protection devices shall be provided to personnel on-site and the area marked as a high-noise zone where ear protection is mandatory.	**Negligible to Minor**
	Minor	TSK PV Project (under construction)	Medium	**Minor**		**Negligible to Minor**
	Minor	Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	**Minor**		**Negligible to Minor**
	Minor	Caravans (local contractors)	Medium	**Minor**		**Negligible to Minor**
Vehicular Noise - Noise from the movement of construction vehicles	**Minor Negative**	Faris Contractor Union	Medium	**Minor to Moderate**	• Limit unnecessary usage of vehicles/equipment - No idling - Equipment to be shut or throttled down when in intermittent use. • Delivery vehicles will be prohibited from waiting outside the site with their engines running (consideration of driver waiting room with air conditioning).	**Minor**
	Minor Negative	TSK PV Project (under construction)	Medium	**Minor to Moderate**		**Minor**
	Minor Negative	Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	**Minor to Moderate**		**Minor**

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impact
	Minor Negative	Caravans (local contractors)	Medium	**Minor to Moderate**	• Ensure any appropriate permits are in place for deliveries to the site and for any works performed outside normal working hours. • Review vendor specifications and accept site plant and vehicles, in particular heavy vehicles, based on noise emissions (as far as practical). • The movement of heavy vehicles during the night will be avoided wherever practical.	**Minor**
Construction vibration impacts (including vehicle vibration)	**Negligible Negative**	Faris Contractor Union	Medium	**Minor**	• The Contractors will, at all times, carry out all work in such a manner as to keep any disturbance from vibration to a minimum. • Operators of vibrating hand-held machinery (if any) will be provided with appropriate PPE (e.g. protective gloves) and be given suitable breaks from using such equipment to reduce the impacts of vibration. • Where practical, all vibratory generating equipment and activities shall be sited away from the Project boundary.	**Negligible to Minor**
	Negligible Negative	TSK PV Project (under construction)	Medium	**Minor**		**Negligible to Minor**
	Negligible Negative	Future Staff (O&M) of TSK PV Plant (Once operational)	Medium	**Minor**		**Negligible to Minor**
	Negligible Negative	Caravans (local contractors)	Medium	**Minor**		**Negligible to Minor**

6.5.2 Operational Phase

Operational Noise

Besides maintenance vehicles and potential low magnitude humming from the electrical transformers (which is not expected be discernible at over 50m distance from source), there will be very few specific point noise sources from the project.

Given the minimal requirements for site activity during operation, impacts from vehicles are also not expected to be major source of noise. As such, operational noise is not expected to be discernible at identified receptor locations. As the magnitude of noise impacts are minimal, further assessment has not been undertaken. Most likely the Faris Union Contractors and local contractors (Caravans) receptors will have move out once plant is operational commences.

Under emergency situations, noise from the emergency diesel generator may be discernible on site, but will unlikely be discernible to off-site receptors.

Vibration

As the PV Project will not contain rotating, vibrating, or other major moving parts, it is not anticipated that the project will result in any discernible operational vibration impacts.

6.6 Monitoring

The minimum expected requirements for the noise monitoring are outlined in the table below. The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan' as part of the respective construction or operational phases ESMS.

Table 6-11 Noise Monitoring Requirements

MONITORING	PARAMETER	FREQUENCY & DURATIONS	MONITORING LOCATION
CONSTRUCTION			
Day time noise	Leq(A)	Weekly for 10-15 minute periods at each location	At site boundaries during construction
Night time noise			

7 SOIL, GEOLOGY AND GROUNDWATER

7.1 Introduction

This section presents an analysis of the potential impacts from the construction and operational activities from the Project on the geology, soil and groundwater of the Project area. This section also includes a description of the soil and groundwater baseline and the geological context of the area. In addition, measures that will be undertaken and implemented in order to mitigate any identified impacts are also identified in this section.

7.2 Standards and Regulatory Requirements

As there are no defined soil and groundwater standards for Egypt or by lenders, the use of the 'Dutch Soil Guidelines' or Dutch standards has been used to a benchmark quality.

The Dutch Standards identify maximum allowable concentrations for contaminants in soil and groundwater. The soil intervention values indicate when the functional properties of the soil for humans, plants and animals is seriously impaired or threatened. They are representative of the level of contamination above which a serious case of soil contamination is deemed to exist. Groundwater target values provide an indication of the benchmark for environmental quality in the long term, assuming that there are negligible risks for the ecosystem. The Dutch Standards for the most significant pollutants are presented in the table below. Where a parameter is not covered by the Dutch Standards, other appropriate international standards shall be used.

Table 7-1 Dutch Soil and Groundwater Standards

PARAMETERS	SOIL (MG/KG DRY MATTER)		GROUNDWATER (µG/L)	
	TARGET VALUE*	INTERVENTION VALUE	TARGET VALUE	INTERVENTION VALUE
Heavy Metals				
Arsenic	29	76	10	60
Barium	160	-	50	625
Cadmium	0.8	13	0.4	6
Chromium	100	-	1	30
Chromium III	-	180	-	-
Chromium IV	-	78	-	-
Cobalt	-	190	20	100
Copper	36	190	15	75
Lead	85	530	15	75
Mercury	0.3	36 (inorganic) 4 (organic)	0.05	0.3

Parameters	Soil (mg/kg dry matter)		Groundwater (µg/l)	
	Target value*	Intervention value	Target value	Intervention value
Molybdenum	3	190	5	300
Nickel	35	100	15	75
Zinc	140	720	65	800
Aromatic Compounds				
Benzene	0.01	1.1	0.2	30
Ethyl benzene	0.03	110	4	150
Toluene	0.01	32	7	1000
Xylene (sum)	0.1	17	0.2	70
Styrene (vinylbenzene)	0.3	86	6	300
Phenol	0.05	14	0.2	2000
Cresols (sum)	0.05	13	0.2	200
Chlorinated Hydrocarbons				
Volatile Hydrocarbons				
monochloroethene (vinyl chloride)	0.01	0.1	0.01	5
dichloromethane	0.4	3.9	0.01	1,000
1,1-dichloroethane	0.02	15	7	900
1,2-dichloroethane	0.02	6.4	7	400
1,1-dichloroethene	0.1	0.3	0.01	10
1,2-dichloroethene (sum)	-	1	0.01	20
Dichloropropanes (sum)	-	2	0.8	80
Trichloromethane (chloroform)	0.02	5.6	6	400
1,1,1-trichloroethane	0.07	15	0.01	300
1,1,2-trichloroethane	0.4	10	0.01	130
Trichloroethene (Tri)	0.1	2.5	24	500
Tetrachloromethane (Tetra)	0.4	0.7	0.01	10
Tetrachloroethene (Per)	0.002	8.8	0.01	40
Chlorobenzenes				
Monochlorobenzene	-	15	7	180
Dichlorobenzenes (sum)	-	19	3	50
Trichlorobenzenes (sum)	-	11	0.01	10
Tetrachlorobenzenes (sum)	-	2.2	0.01	2.5
Pentachlorobenzene	-	6.7	0.003	1
Hexachlorobenzene	-	2.0	0.00009	0.5
Chlorophenols				
Monochlorophenols (sum)	-	5.4	0.3	100
Dichlorophenols (sum)	-	22	0.2	30
Trichlorophenols (sum)	-	22	0.03	10
Tetrachlorphenols (sum)	-	21	0.01	10

Parameters	Soil (mg/kg dry matter)		Groundwater (µg/L)	
	Target value*	Intervention value	Target value	Intervention value
Pentachlorophenol		12	0.04	3

- **Note**: The soil values are calculated for a 'Standard Soil' with 10% organic matter and 25% clay. A case of environmental contamination is defined as 'serious' if >25 m³ soil or >100 m³ groundwater is contaminated above the intervention value.
- **Source**: Soil Remediation Circular 2009, Annex 1: Groundwater target values and soil and groundwater intervention values. (*Target values for soil refer to 2000 version as they are not present in the 2009)
- Where contaminants are found to exceed 'intervention' levels, this is considered to be a case of soil contamination, which is dangerous to the health of humans and the natural environment. Such a level of contamination should prompt a need for remediation, appropriate treatment and disposal.

7.2.1 Other Lender Requirements

IFC Requirements

The IFC Performance Standards requires adherence to IFC Performance Standard 3 on 'Resource Efficiency and Pollution Prevention' requires the client and/or the Project to:

- Avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; and
- Prevent the release of pollutants to water and land due to routine, non-routine, and accidental circumstances, or when not feasible, minimize and/or control the intensity and mass flow of their release.

European (EBRD) Requirements

The EBRD PR3 on Resource Efficiency and Pollution Prevention and Control establishes general requirements pollution prevention as follows:

- The assessment process must identify technically and financially feasible pollution prevention and control techniques that are best suited to avoid or minimise adverse impacts on human health and the environment and are appropriate to the nature and scale of the project's adverse impacts and issues; and
- The Project must meet the relevant EU substantive environmental standards, where these can be applied at the project level. Where no EU substantive environmental standards at project level exist, the Project will identify, in agreement with the EBRD, other appropriate environmental standards in accordance with GIP.

AFDB

AFDB Safeguards and Sustainability series Volume 2, Issue 1 includes general requirements for pollution prevention as follows:

- The borrower or client shall apply pollution prevention and control measures consistent with national legislation and standards, applicable international conventions, and internationally recognized standards and good practice – particularly the World Bank Group Environmental, Health and Safety (EHS) Guidelines;
- Sources of pollution include hazardous or non-hazardous chemicals in the solid, liquid or gaseous phases, and other forms, such as pests, pathogens, thermal discharge to water, nuisance odours, noise, vibration, radiation, electromagnetic energy and the creation of potential visual impacts including light; and
- The borrower or client's responsibility is to prevent the discharge of pollutants into the air, surface and groundwater, land and soil. If total prevention is not feasible, the borrower or client shall take specific actions to reduce or minimize the effluents or volume of discharges. This applies to the release of pollutants during planned activities as well as unplanned events or emergencies that may result in local, regional, and transboundary impacts.

7.3 Baseline Data

7.3.1 Geology & Geomorphology

The ACWA Power project site is located in Nubian region of the Egyptian Western Desert, close to the western fringes of the flood plain of the Nile River of upper Egypt. The Western Desert, which is bordered by the Nile Valley in the east and Libyan border on the west, forms a uniform surface that is seldom broken by relief features. It is a mostly flat plateau gently sloping down from southwest to northeast. The flat surface of the Western Desert plateau is interrupted in several places with numerous closed-in depressions of various sizes that can sometimes reach below sea level. Longitudinal, northwest – southeast trending sand dunes run across the flat surface of that desert. Massive sand accumulations occur in many places but reach their greatest proportions in the Great Sand Sea at the extreme west close the Egyptian Libyan border.

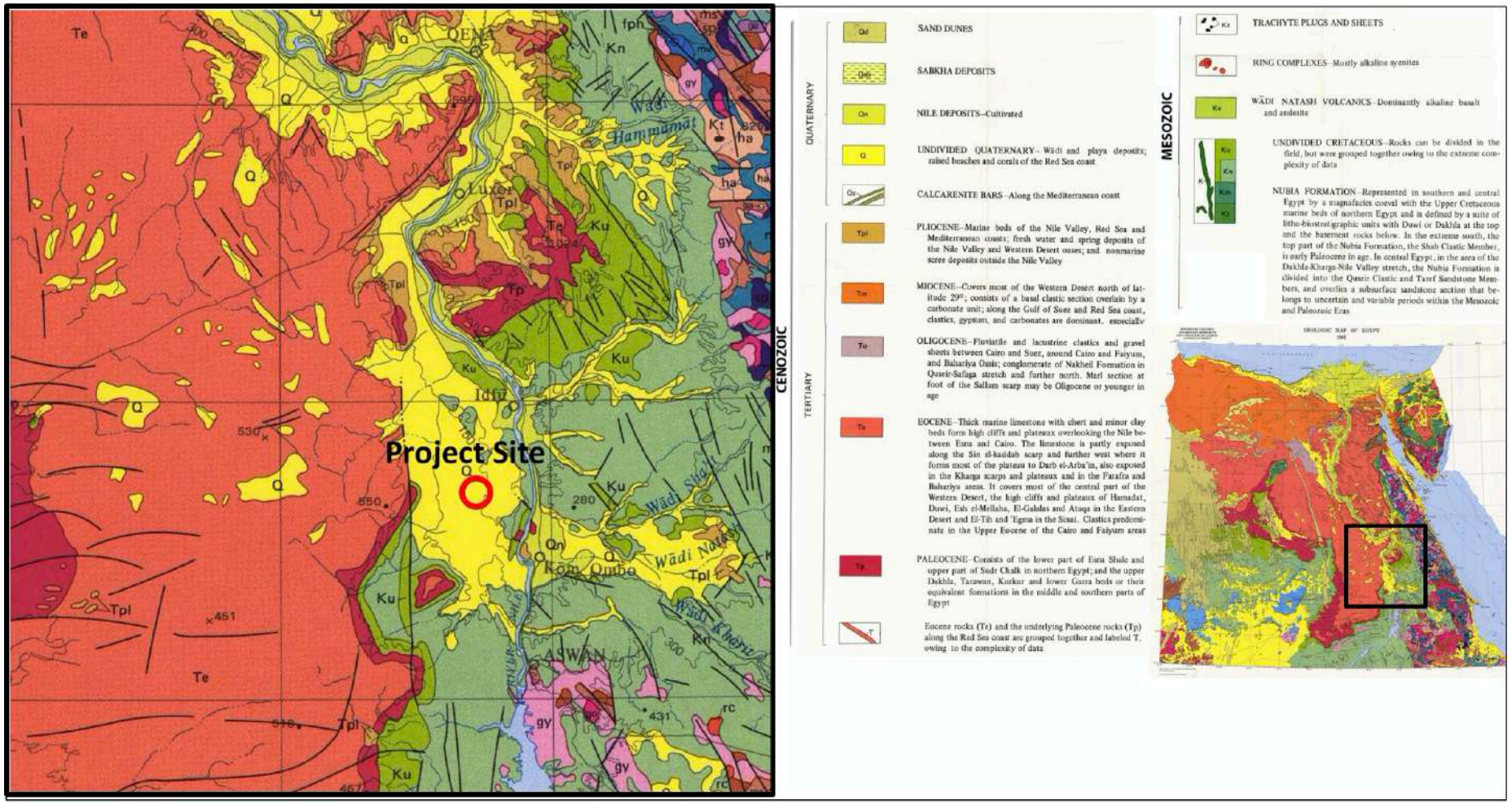
The south-eastern region of the Western Desert where the project area is located, forms an almost featureless plain, which offers few prominent topographical or geological features that would reflect its intricate geological history. Most of the surface is covered with gentle-dipping Neogene strata of moderate lithological uniformity. Topographically, a monotonous plain extends from the shores of the Pliocene Messinian Marine Gulf, which marks the present-day valley of the Nile, to the eastern flank of the Libyan Plateau. The monotony of the plain is only rarely interrupted by occasional low questas.

West of that plain, the Libyan Plateau, runs parallel to the Nile Valley and less than 100 km to the west of it. The rugged, extremely arid bad land that forms the surface of this plateau presents a formidable barrier separating the Nile Valley from the sandy interior of that desert.

The project site and the surrounding area are located in the gravel to sandy plain extending between the Libyan Plateau and the Nile Valley. The site has a nearly flat topography ranging in altitude between 150 to 140 meters above sea level and some 70 above the Nile water level in that region. About 30 to 40 km to the west, the Eocene limestone Libyan Plateau rises to the moderate height of 400 to 500 meters and extends westwards to the edge of the great hollow that forms the Baris – Kharga - Dakhla depression with its many oases. To the east, and for the last 1 to 2 kms, the flat desert plain slopes down steeply into the Nile Valley to reach the nearly flat flood plain, which is only few meters above the Nile water. **Error! Reference source not found.** shows a relief map of Egypt indicating the project site.

The project site proper has a largely flat, slightly rolling topography. The ground surface is mostly covered with Quaternary surface deposits of mostly Late Pleistocene. A layer of sand, over-strewn with gravel in places covers the entire area. Some scattered cobles are also found at very few spots. The gravel and cobles are most likely the result of ancient surface flows. At the present time, however, there is no clear pattern in the distribution of these gravel surfaces in relation to the topography of the area and no surface drainage lines were detected anywhere at or near the site. Ancient drainage lines of the eastern flank of the Libyan Plateau, which are visible in satellite imageries, are quickly lost once they reach the plain, tens of kilometers west of the site. These shallow, ill-defined drainage lines have been inactive at least since the last wet episode of the early Holocene and have been mostly buried in recent, mostly aeolian sediments. The figure below shows the location of the site on the Geological Map of Egypt.

Figure 7-1 Geological Map of Egypt with Reference to Project Site



7.3.2 Seismology

According to the geotechnical investigation conducted in 2016, the study area was considered seismic for the longest time, especially after the occurrence of the earthquake (M 5.3) in Kalabsha area on 14th November 1981 (about 60 km to the south of Aswan, a few numbers of earthquakes were recorded and located north of Aswan city, in Idfu area (presented in Table below).

Table 7-2 List Earthquakes Recorded

Table 1: Parameters of the used earthquakes in this study:

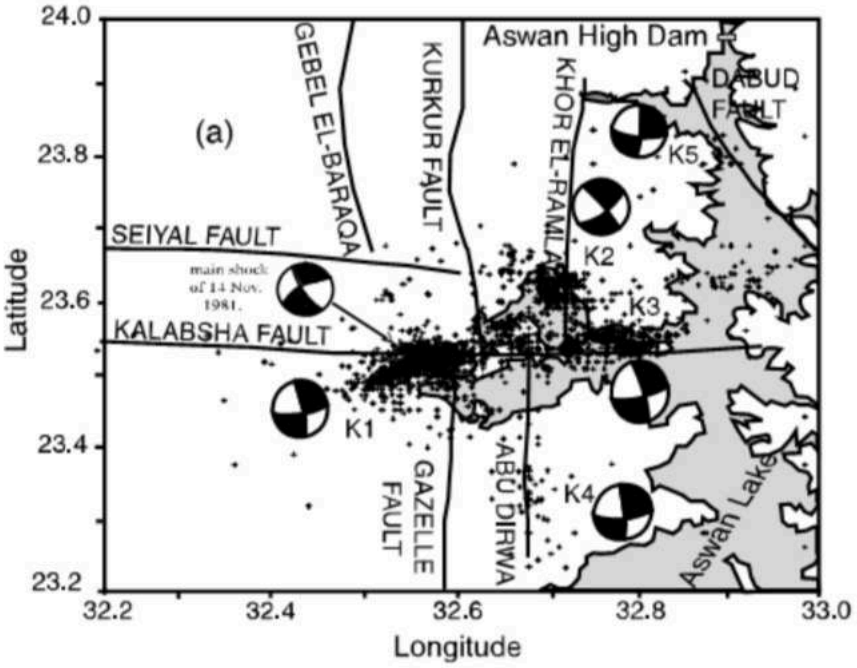
No.	Date			O.T		Location		M
	y	m	d	h	m	Lat	Long	
1	1982	04	04	08	56	24.76	33.27	3.8
2	1993	02	18	12	12	25.08	33 09	2.9
3	1999	06	22	16	38	25.10	32.99	2.4
4	1999	09	28	03	57	24.92	32.86	2.5
5	1999	09	16	23	21	25.03	32.86	2.3
6	2003	03	22	12	38	24.69	32.45	2.9
7	2004	09	17	03	04	25.11	32.68	1.9
8	2005	02	24	08	46	24.93	32.57	3.3
9	2006	12	13	12	22	25.03	32.72	4.0

The seismic activity in Aswan can be divided into two (2) zones as follows (Hamza Associates, 2016):

- First zone: the activity is distributed roughly north-south (N-S) around the main fault in the Nile which delimits Gulf of Suez–Red Sea fault trend (N35° W);
- Second zone: the activity is distributed approximately parallel to the main trend of Gabal el-Barqa fault;

Based on the above, the seismic activity in the Project area is also divided into two (2) zones and is related to the long segment in the Nile as well as to Gabal el-Barqa fault which is one of the Western Desert fault system. The Western Desert fault system is related to the active plate margin to the east; therefore, the activity in the area may be related to the active plate margin in the east. Furthermore, the seismicity is concentrated along the easternmost section of Kalabsha fault, particularly at the intersection between the north-south and east-west fault systems (shown in Figure below). The seismicity is concentrated in main five cluster zones that are Gebel Marawa, Khole El-Ramla, east Gebel Marawa, Abu Dirwa, and old stream zone. The first seismic zone is located on the Kalabsha fault, which is the only deep cluster with depths greater than 15km, while the other seismic zones are characterized by shallow depths less than 15km (Hamza Associates, 2016).

Figure 7-2 Spatial Distribution of Earthquakes in Aswan – Geotechnical Investigation 2016 (Hamza Associates, 2016)



7.3.3 Floods

After the completion of the establishment of the Aswan High Dam and Lake Nasser in Egypt, the crisis's situation in Egypt had changed where the natural disasters related to water, especially the Nile floods were stopped and after that time, Egypt started experiencing the catastrophic flash flooding, which is more common in coastal areas such as the Red Sea and Sinai, particularly where storms hit large settlements. These coastal areas are occasionally subjected to heavy showers during winter times, followed by sporadic torrential floods that may cause disastrous damage to roads and the sporadic settlements (Hamza Associates, 2016).

The flood hazards in Aswan area mostly are related to the high topographically mountainous areas in the eastern desert, so the rainfall flood flash hazards based on the available published data and literature review are recorded in the eastern side of Nile Valley Hamza Associates, 2016).

7.3.4 Soils

Historical Sources of Information

The topography of the Project site is mainly flat with small hills ranging in elevation from 2 m to 4 m above the main elevation of the area which is ranges from 146.5m to 148m above sea level (Hamza Associates, 2016).

A geotechnical investigation was carried out in May 2016 for the 200 MW Kom Ombo PV Project site. A total of ten (10) boreholes were drilled to a depth of 10 m in the project area. Location of boreholes are shown the Figure below. The investigation revealed the geology at the Project site comprises of wadi deposits overlying sand layers as shown in the Table below. The surface and subsurface soils encountered during investigation included:

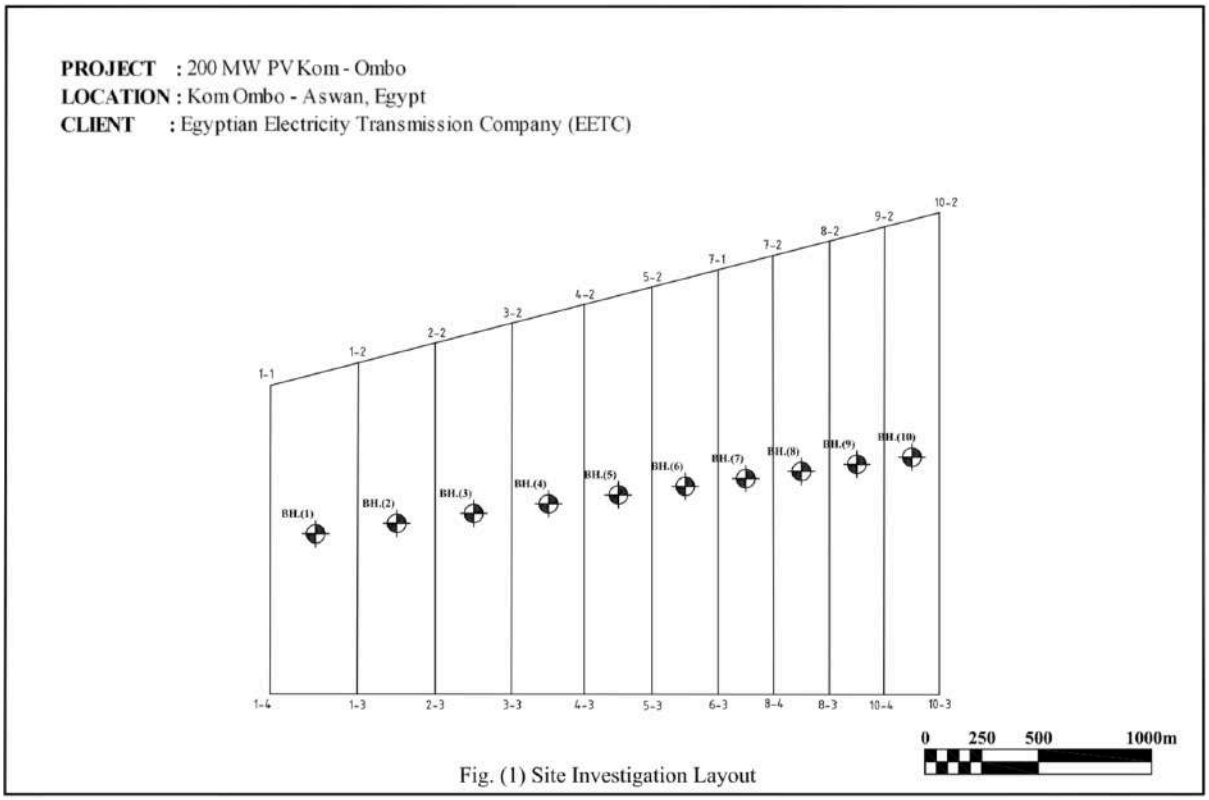
- Wadi deposit: reddish brown calcareous wadi deposit that consist of sand, gravel, silt and iron oxides. This layer appears at all the boreholes from ground surface to depth ranging from 1.0m to 6.0m below ground surface.
- Sand: Very dense poorly graded calcareous sand with trace of iron oxides. The soil is reddish brown and varies from silty sand to sand with silt. This layer appears in all boreholes from depth ranging from 1.0m to 6.0m with thickness varying from 2.8m to 9.44m.
- Silt: Silt was only encountered in borehole 10. This consisted of greyish brown hard silt (5.8m to 8m) and elastic silt (8m to 10m) interbedded by thin (2-5m) and thick (5-10mm) laminae of sandy clay with trace of iron oxides.

Generally, the soil at the site is mainly alkaline with pH ranging from 7.3 to 7.5.

Table 7-3 Geology of Project Site – 2016 (Hamza Associates, 2016)

Borehole No.	Wadi Deposit Upper Layer		Sand Layer		Silt Layer	
	Top	Thickness	Top	Thickness	Top	Thickness
BH1	0	3	3	7.1 (E.O.B.)	-	-
BH2	0	1	1	9.44 (E.O.B.)	-	-
BH3	0	6	6	4.11 (E.O.B.)	-	-
BH4	0	2	2	8.28 (E.O.B.)	-	-
BH5	0	3	3	7.45 (E.O.B.)	-	-
BH6	0	3	3	7.1 (E.O.B.)	-	-
BH7	0	5.95	5.95	4.19 (E.O.B.)	-	-
BH8	0	3	3	7.12 (E.O.B.)	-	-
BH9	0	4.5	4.5	5.62 (E.O.B.)	-	-
BH10	0	3	3	2.8	5.8	4.2 (E.O.B.)

Figure 7-3 Borehole Locations – Geotechnical Investigation 2016 (Hamza Associates, 2016)



Surface Soil Investigations – 2020

A soil investigation has been conducted on the 2nd of February 2020 to identify existing soil quality conditions and characteristics at the Project site. During the survey, soil samples were collected from 10 sampling locations as shown in Figure below. Eight (8) of these sampled top soil for a depth of about 10 cm, and two (2) sampled subsurface sediments at a depth of about 50 cm. The soil sampling locations were selected to represent the following settings:

- Areas near the road (Samples 1 and 2);
- Vegetated areas (Samples 3 and 5);
- Barren areas with no signs of frequent crossing by vehicles (Samples 4, 9 and 10); and
- Barren areas extensively crossed by cars and other construction equipment, near the contractor's buildings (Samples 6, 7 and 8).

Soil pH, total dissolved solids (TDS) and electric conductivity (EC) were measured in 1:1 soil to bi-distilled water ratio using HANNA (HI93300) combined electrode (Hanna Instruments, Italy).

Four (4) soil samples (Samples 1, 3, 4 and 6) were analysed for Total Petroleum Hydrocarbons (TPH), Nitrate, Total Phosphorous and suite of heavy metals. The selection of the sampling sites was intended to assess potential soil contamination as a result of different levels of human-

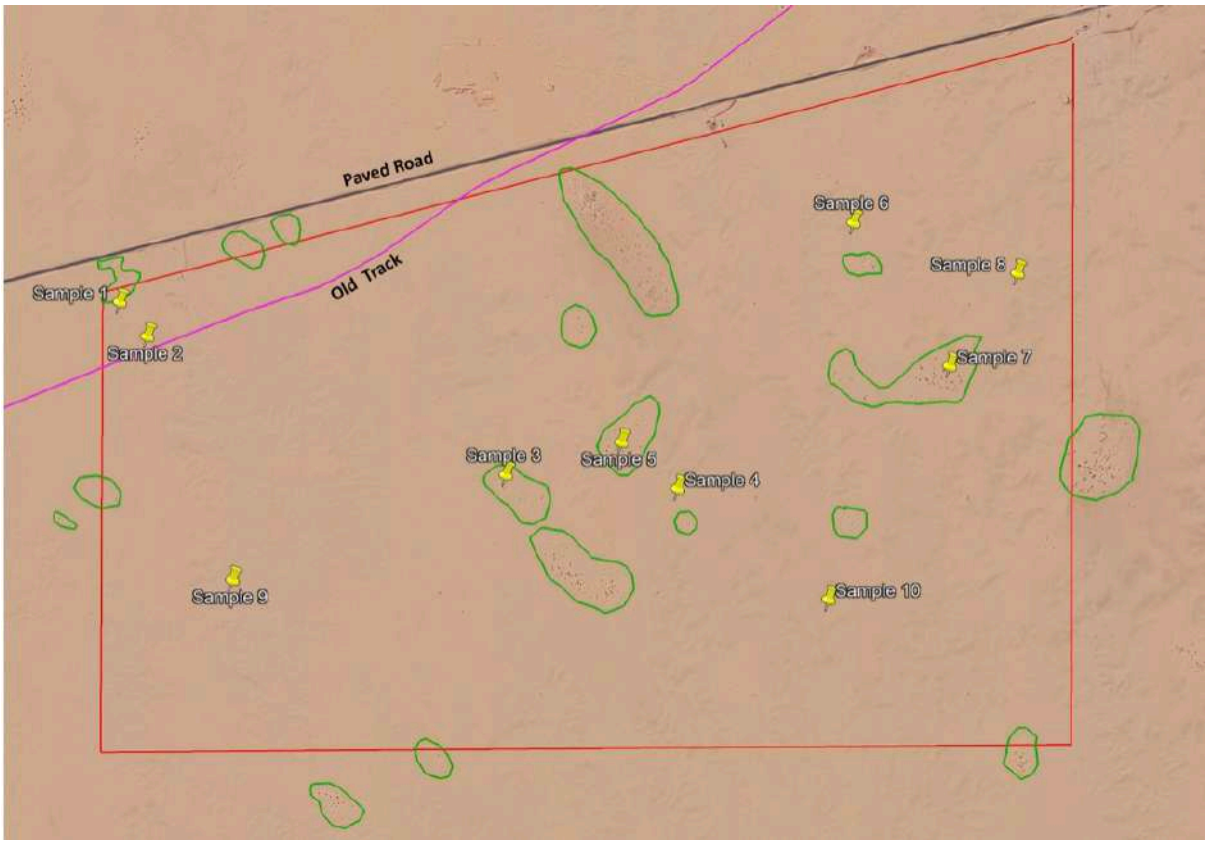
induced disturbance of the site, if any (laboratory soil results are provided in **Appendix G**). The following is a brief description of the conditions of the sampling sites:

- Sample 1: An area at the north-western corner of the site, about 75 meters south the Faris road and about an equal distance north of the old, Faris desert track. The location is at the edge of a large stand of desert plants. Old car tracks are the only signs of previous human activity in the area;
- Sample 3: An area of natural vegetation near the centre of the site. No signs of previous human activities in the area;
- Sample 4: A barren area near the centre of the site; and
- Sample 6: An area southeast of the contractors' buildings. Signs of extensive disturbance of surface sediments as a result of movement of vehicles and possibly heavy construction equipment.

All analysis was carried out at the Central Soils Laboratory of the Ministry of Agriculture and Land Reclamation (Soil, Water and Environment Analysis and Studies Unit, Soil, Water and Environment Research Institute, Agricultural Research Centerm Cairo, Egypt). Coordinates are presented in Table below along with grain size.

Egypt's environmental legislations do not have official standards for soil contamination. Some tentative standards, based on some international standards are in current use by the Egyptian Environmental Affairs Agency (EEAA), are unofficially used to guide decision regarding soil contamination levels. Until incorporated into relevant laws, these (or other standards) are not legally enforceable. These tentative standards are used to bench mark results of our soil analysis.

Figure 7-4 Soil Sample Locations



Results

Granulometric Composition: The surface sediments of the project site are predominantly sandy with variable quantities of gravel. All surface sample appeared poorly sorted, with medium to coarse grain sand constitutes 35.7 and 36.8% of the sample on the average respectively. Considerable variations are found among samples with percentage of medium and coarse sand ranging from 8.8 to 51.1 and 21.3 to 63.3 respectively. Finer sand and silt constitute a small percentage of the surface sediments but is particularly high in areas where plants grow. Subsurface sediments are well sorted, with gravel and coarse grain sand forming most of the sediments.

Table 7-4 Grain Size Composition

Sample Type		No.	Location	Grain Size						
				4 mm	2 mm	500 µM	250 µM	125 µM	63 µM	<63 µM
Sediment Type	Surface	1	24° 36' 59.20" N, 32° 46' 52.71" E	61.0	75.2	504.8	533.6	168.9	30.5	3.7
				44%	5.5%	36.6%	38.7%	12.3%	2.2%	0.3%
		2	24° 36' 55.90" N, 32° 46' 55.61" E	270.1	42.2	284.9	471.8	149.2	28.1	2.6
				21.6%	3.4%	22.8%	37.8%	11.9%	2.3%	0.2%
		3	24° 36' 42.61" N, 32° 47' 33.49" E	4.7	10.4	553.1	588.3	262.1	87	9.8
				0.3%	0.7%	36.5%	38.8%	17.3%	5.7%	0.7%
		4		399.8	75.5	485.8	365.3	104.9	14.9	1.3

Sample Type		No.	Location	Grain Size						
				4 mm	2 mm	500 µM	250 µM	125 µM	63 µM	<63 µM
			24° 36' 41.27" N, 32° 47' 51.64" E	27.6%	5.2%	33.6%	25.2%	7.3%	1%	0.1%
		5	24° 36' 45.73" N, 32° 47' 45.67" E	33.3	47.6	381.3	599.2	80.1	28.4	4.0
				2.8%	4.1%	32.5%	51.1%	6.8%	2.4%	0.3%
		6	24° 37' 06.83" N, 32° 48' 10.20" E	91.7	104.9	1026	236.9	132.5	27.6	1.7
				5.6%	6.5%	63.3%	14.6%	8.2%	1.7%	0.1%
		7	24° 36' 53.05" N, 32° 48' 20.35" E	23.7	22.2	322.6	403.2	70.4	32.9	3.1
				2.7%	2.5%	36.7%	45.9%	8%	3.8%	0.4%
		8	24° 37' 01.95" N, 32° 48' 27.50" E	115.2	85	455.5	471.2	220.5	46.8	4.9
				8.2%	6.1%	32.6%	33.7%	15.7%	3.3%	0.4%
		Average		124.9	57.9	501.8	458.7	148.6	37.0	3.9
				14.1%	4.3%	36.8%	35.7%	10.9%	2.8%	0.3%
	Sub-surface	9	24° 36' 32.49" N, 32° 47' 04.61" E	464.3	449.5	377.5	233.2	183.4	52.3	10.1
				26.2%	25.4%	21.3%	13.2%	10.3%	3%	0.6%
		10	24° 36' 30.65" N, 32° 48' 7.56" E	163.3	615.8	380.2	129.2	118.7	49.7	11.4
				11.1%	41.9%	25.9%	8.8%	8.1%	3.4%	0.8%
		Average		313.8	532.7	378.9	181.2	151.1	51.0	10.8
				18.7%	33.7%	23.6%	11.0%	9.2%	3.2%	0.7%

Figure 7-5 Grain Size Composition

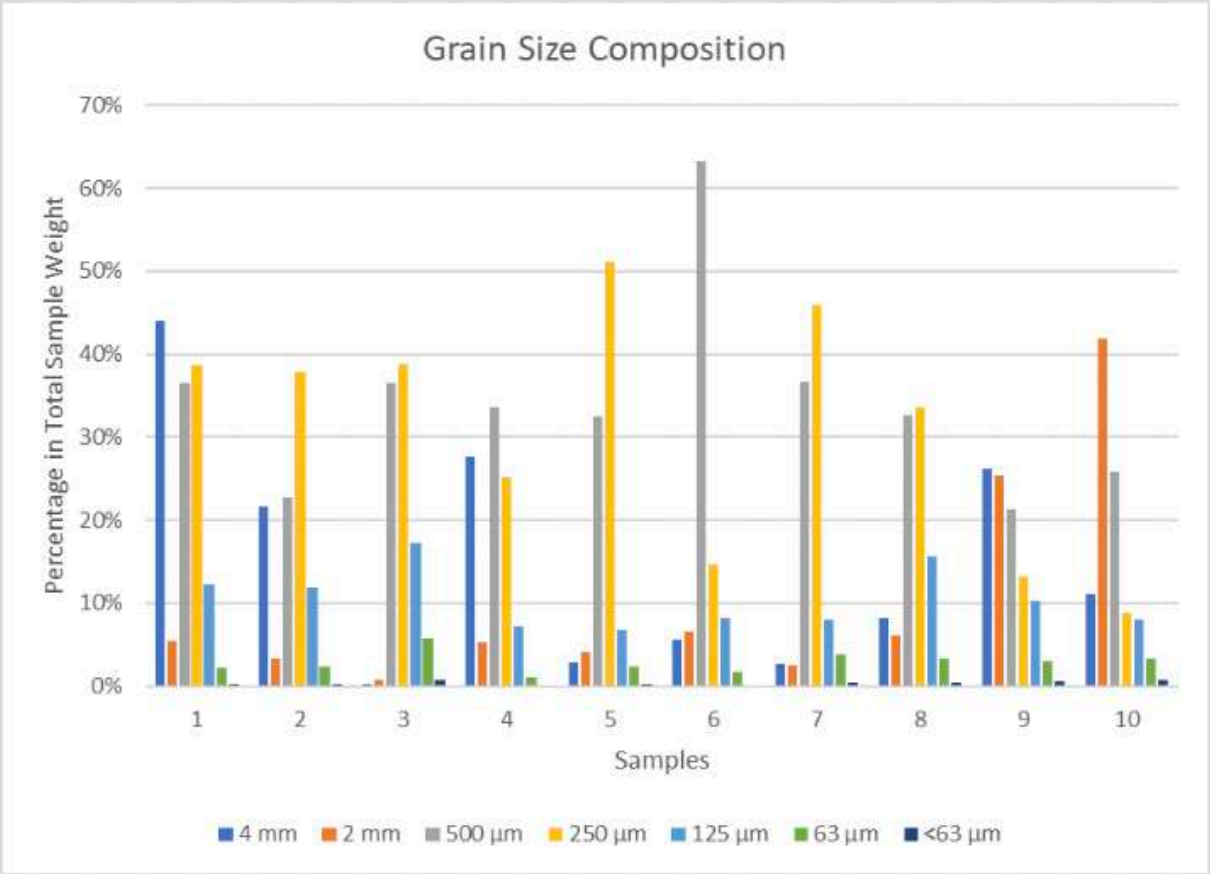


Table below presents the physical properties of ten soil samples taken at different location within the project site.

Table 7-5 Physical Parameters

Sample		No.	Location	TDS (ppm)	EC (µS)	pH
Sediment Type	Surface	1	24° 36' 59.20" N, 32° 46' 52.71" E	71	140.6	8.74
		2	24° 36' 55.90" N, 32° 46' 55.61" E	206	415	8.74
		3	24° 36' 42.61" N, 32° 47' 33.49" E	161	322	8.54
		4	24° 36' 41.27" N, 32° 47' 51.64" E	753	1500	8.61
		5	24° 36' 45.73" N, 32° 47' 45.67" E	257	496	8.63
		6	24° 37' 06.83" N, 32° 48' 10.20" E	157	311	8.64
		7	24° 36' 53.05" N, 32° 48' 20.35" E	250	501	8.25
		8	24° 37' 01.95" N, 32° 48' 27.50" E	133	261	8.46
		Average		**248.5**	**493.3**	**8.58**
	Sub-surface	9	24° 36' 32.49" N, 32° 47' 04.61" E	2.75	5.42	8.1
		10	24° 36' 22.66" N, 32° 46' 52.97" E	1.64	3.35	8.33
		Average		**2.2**	**4.39**	**8.22**

All surface soil samples were moderately alkaline in reaction, with an average pH of 8.25 and ranging from 8.25 for sample 7 and 8.74 for sample 1. Salinity was generally low with total dissolved solids averaging 248.5 ppm and ranging between 71 and 753 ppm in samples 1 and 4 respectively. Electrical conductivity values reflect these variations in TDS. It is not clear what causes these variations in salinity. It may be that the high TDS of some locations is the result of collection and subsequent evaporation of run-off water after either recent or ancient rains. However, the two sub-surface samples showed considerably lower salinity, averaging only 2.2 TDS ppm and 4.39 micro siemens/cm and were less alkaline than surface samples. This strongly suggests that the increased surface salinity is caused by modern time, rather than ancient rains.

The results of the soil laboratory chemical analysis are presented in the table below and compared with the Dutch Soil Standards, standards currently used by the EEAA for assessing level of land contamination.

Table 7-6 Soil Analysis Results

Parameter	Soil Sample				EEAA Standards[1]	Dutch Standards[2]
	1	3	4	6		
pH	8.74	8.54	8.61	8.64	-	-
Electrical Conductivity (µs)	140.6	322	1500	311	-	-
Total Dissolved Solids (ppm)	71	161	753	157	-	-
Potassium (mg/kg)	168	228	92	243	-	-
Aluminium (mg/kg)	57	53	67	59	-	-
Arsenic (mg/kg)	8.6	6.9	5.8	8.3	17	55
Cadmium (mg/kg)	0.86	0.28	0.32	0.33	1	12
Chromium (mg/kg)	69	104	67	54	71	380
Cobalt (mg/kg)	30.7	15.4	13.8	22.1	21	240
Copper (mg/kg)	1.32	0.62	0.95	0.62	85	190
Lead (mg/kg)	0.86	0.28	0.32	0.33	120	530
Mercury (mg/kg)	0.132	0.19	0.08	0.165	0.23	10
Nickel (mg/kg)	0.16	0.20	0.19	0.15	43	210
Iron (mg/kg)	3.28	0.15	0.28	0.08	-	-
Zinc (mg/kg)	0.156	0.202	0.19	0.152	160	720
Nitrate (mg/kg)	59.0	60.0	68.0	72.0	-	-
Total Phosphorous (mg/kg)	31	22.5	14.0	55.2	-	-
Total Petroleum Hydrocarbons (mg/kg)	29.4	44.6	17.3	30.9	-	-

[1] Informally adopted land contamination standards, (EEAA)
[2] Intervention Value
Note: Detection limits have not been provided by the laboratory and have been requested by 5 Capitals.

The following summarises the results of the soil investigation:

- The concentrations of all heavy metals were recorded below the established Dutch limit (intervention values);
- Chromium was the only heavy metal with a concentration higher than the land contamination standards adopted by EEAA (unofficial) for one location (sample 3);
- Cobalt concentrations exceeded EEAA's land contamination standards (unofficial) for two (2) locations (Samples 1 and 6);
- Traces of Total Petroleum Hydrocarbon (TPH) were detected in all four (4) samples[3]. This may be due to one of the following:
  - Off roading carried out by the locals and local contractors who are currently providing different services to the neighbouring PV project located approximately 100m from the north eastern corner of the Project Site (closer to sample 6);
  - Previous use of the site by vehicles prior to the construction of the paved road bordering the site form the North (approximately in 2007). An old, dirt road/track that once connected Faris to the Luxor - Aswan road passes through the Project site (and is visible on Google satellite imageries of the site). This dirt route most likely was used by many vehicles prior to construction of the present road. It is also a common practice for vehicles using desert tracks to leave the track as it gradually becomes rough as a result of years of use; and
  - There are several oil production facilities within the wider area, which mostly likely was extensively used by many vehicles during the oil exploration and subsequent production activities.

7.3.5 Surface Water

The Nile River is located approximately 11 km east of the Project site. According to the EIA conducted in 2014, most of the irrigation network is located east of the Nile at this area, except for a main irrigation canal that has an intake from the River Nile about 2 km south of Faris Village and passes to the north for about 6 km feeding smaller canals (mesqas) (DNV, 2014).

According to the 2014 ESIA, the locals at Faris village were facing flooding and the elevation of the groundwater to surface levels damaging the agricultural land and buildings

[3] Detection limits have not been reported by the laboratory, however have been requested by 5 Capitals.

foundations. Based on the EIA, the reasons for the flooding of groundwater may have been due to the following (based on feedback from Faris locals):

- The inhabitants of Faris relate this to a seismic survey that took place in the village by a Petroleum company in 2009, in which explosives were used as source of seismic energy;
- The villagers noticed flooding of groundwater in their village and the farms around it right after a seismic survey in the area.

This was also observed during the initial stakeholder consultation conducted in December 2019 for this ESIA. The locals at Faris Village complained of the seepage of wastewater into their homes and groundwater flooding which is causing damage to the foundations of their houses. The reasons behind the elevation of groundwater levels and wastewater is currently unknown, however, locals still believe it is related to the drilling being carried out by the Petroleum company in the area.

All activities related to the Project site are considered far from the Nile and will not involve any intrusive activities or drilling that might impact the Village. These will be outside of the Project's areas of influence.

7.3.6 Groundwater

Based on the 2014 EIA, in the reclaimed lands west of Faris, groundwater was being pumped from depths in the range of 70-100 meters for irrigation, as these lands have relatively high elevations to be irrigated by surface water. The main groundwater aquifer is the Nubian Sandstone Aquifer, which is a large hydrogeological system with extensions into Libya and Sudan. Generally, the Nubian Sandstone Aquifer in Aswan region is concealed underneath a cover of sedimentary rocks, the aquifer is a non-renewable resource and the general water gradient is from south to north, and in areas near the Nile Banks the gradient is generally towards the river (DNV, 2014).

At the Project site and during the 2016 geotechnical investigation, groundwater was not encountered in any of the boreholes at the time of investigation. However, it is anticipated that groundwater may exist at depth lower than 10m (the deepest extent of the boreholes).

7.4 Sensitive Receptors

Table 7-7 Geology, Soils & Groundwater - Receptor Sensitivity

RECEPTOR	RECEPTOR SENSITIVITY	JUSTIFICATION
Soil Quality	**Low**	The soil at the project site is common for the wider region.
Groundwater	**Medium**	Local groundwater may be used by local populations as a potable resource or for other irrigation purposes

Receptor	Receptor Sensitivity	Justification
		(away from the Nile) and therefore potentially provides a utility service.

7.5 Potential Impacts, Mitigation, Management & Residual Impact

7.5.1 Construction Phase

Site preparation, infrastructure, civil works, electrical and mechanical works and other construction related activities will result in interactions with site geology, and may affect chemical and physical properties of the local soil and potentially groundwater quality.

Excavation or Removal of Soils

The Project will require excavation activities in order to establish a base at suitable level and design elevation for construction. Soil compaction using vibratory rollers to provide soil structural stability after the removal of soils will have direct impacts to surface soils thereby changing soil characteristics within the Project site.

Cross Contamination of Soil

Although a greenfield site, the possibility of encountering some form of contamination due to accidental spills or leaks in areas within the Project site that have been used previously cannot be ruled out. In the event that such contamination is present within the Project site (or arises from construction works), there is a possibility for construction activities particularly those related to site clearance, excavation etc. to spread contaminated soils to other soils. The same impact may occur where contamination impacts caused by construction works are also cross-contaminated in the same respect within the Project site.

Spill and Leaks Associated with Construction

Soil (directly) and groundwater (potentially indirectly) will be susceptible to contamination from various sources during the construction process. Storage and usage of fuels, chemicals and sanitary provision during the construction phase will introduce risks associated with spills and leaks to ground. These are commonly associated with the transport, handling and storage of such materials.

The risk of accidental spillage and leakage of various chemical products, are often attributable to storage areas of the construction site as well as during the transportation of such materials on and off the site. Improper methods of storing, transferring, and handling of these products can result in spillage to the ground and result in soil contamination.

Due to the depth of groundwater 70-100m, it is not expected that contamination will reach groundwater. However, in instance of possible source-pathway linkage the spread of pollution could increase quite rapidly and can prove difficult to control. These risks will be managed through the implementation of the project CESMP and associated plans and procedures.

Inadequate Waste and Wastewater Management

Construction of the proposed project will involve activities that generate solid non-hazardous and hazardous waste, as well as potential liquid wastes resulting from sanitary waste streams. Waste generated during these activities poses a threat to the site soils. Of particular concern is the management of hazardous waste generated during the construction phase and its handling. Although the hazardous fraction of construction waste such as used oil, machinery lubricants and paints, etc. will represent a very small proportion of the total amount of construction waste it will however require special attention for management and disposal.

If the temporary storage and handling of such waste on the construction site is inadequate prior to being removed for disposal, the risk of soil and potentially indirect effects to groundwater quality increases. Potential environmental impacts arising from the generation of hazardous wastes are covered in the 'Solid Waste and Wastewater Management' Section of this report.

Table 7-8 Geology, Soils and Groundwater Impact Significance, Mitigation & Management Measures and Residual Impacts – Construction

Potential Impact	Magnitude of Impact	Receptors	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
Cross-Contamination of soil during construction	**Minor Negative**	Soil Quality	Low	**Negligible to Minor**	• Training - Contractor staff to be able to identify signs of potential contamination (smell of hydrocarbons, staining). • Washing of equipment, machinery and vehicles will only be permitted in designated areas, with impermeable surfaces and dedicated drainage systems that lead to separate sumps or, treatment facilities and/or lined evaporation ponds. • Where concrete washout areas will be established onsite, these areas should be located away from storm drainage & water bodies and should be designed with adequate holding capacity. The wastewater should be contained within the designated impervious bund. • If contaminated soils are observed during construction activity, the identified contaminated soil should be excavated separately, and stored or disposed of in accordance with the waste management plan as hazardous waste, to avoid cross-contamination. • Any imported soils brought to the site will be from accredited quarries with certificate of quality	**Negligible**
Pollution from Accidental Leaks & Spills	**Minor Negative**	Soil Quality	Low	**Negligible to Minor**	• EPC Contractor will develop a Hazardous Material Storage and Handling Procedure identifying locations of hazardous material storage, storage requirements and handling procedures. • Storage of all hazardous materials such as fuels and chemicals on an impermeable base with liners and/or secondary containment bund with enough capacity to hold 110 % of the maximum volume stored. • Store all chemicals/materials according to manufacturer's instructions and MSDS. • All machines using oils will have drip trays underneath to capture any oil leaks or drips. • Washing equipment, machinery and vehicles will only be permitted in designated areas, with impermeable surfaces and dedicated drainage systems that lead to separate treatment facilities and/or lined evaporation ponds.	**Negligible**

Potential Impact	Magnitude of Impact	Receptors	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
	Negligible Negative	Groundwater Quality	Medium	**Negligible to Minor**	• EPC Contractor will develop and maintain an Emergency Response Plan (ERP) and Spill Response and Contingency. • Maintain an inventory of all potentially hazardous materials and chemicals used and stored on-site. • All spills and leaks will be reported promptly to the HSE Manager and Project Company to be investigated to confirm the cause and put in place appropriate corrective/preventative actions. • Where approved by project company refuelling and limited maintenance of vehicles/equipment will be within a dedicated depot area at the camp, on an impermeable surface. • Availability of suitable containment and spill clean-up materials/equipment at specific locations within the project site (e.g. where refuelling is to take place). • Relevant personnel will be trained on emergency and spill response, containment, material handling and storage procedures. • Regular emergency drills to practice timely and effective spill response. • Fuel transport vehicles and equipment will be maintained and routinely inspected to ensure the tank, pumps, pipe work and vehicle itself are free from any leaks and fit for purpose-No equipment will be placed in service until deficiencies are corrected. • Implement regular maintenance program of vehicles and equipment to minimise leaks or mechanical failures and keep document evidence. • No storage of hazardous chemicals, materials, oils or fuels within 100 m of the shoreline or unprotected storm water drains/channels.	**Negligible**

Potential Impact	Magnitude of Impact	Receptors	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
Waste and Wastewater	**Minor Negative**	Soil Quality	Low	**Negligible to Minor**	• The implementation of the project CESMP and associated Waste Management Plan and Procedures will ensure that spills are kept to a minimum and are cleaned up quickly using spill kits located in risk areas. • Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, and their disposal route. • Implementation of good housekeeping practices during construction activities including procedures and requirements for proper handling, storage, and transport of hazardous materials and waste. • The EPC Contractor and sub-contractors will provide induction training and Tool Box Talks (TBTs) relating to the management, transportation and handling of hazardous materials and wastes • Concrete washout shall only be undertaken designated and signed areas, with adequate protection to soils, to prevent leaks of spread of wastewater.	**Negligible**
	Negligible Negative	Groundwater Quality	Medium	**Negligible to Minor**		**Negligible**

7.5.2 Operational Phase

Specific project impacts to soil, groundwater and geology are not expected during the operational phase as the site will be static and will not have on-going interactions with these parameters. Potential risks of concern during the operational phase are expected to be limited to the management and storage of hazardous materials/wastes/wastewater, chemicals and fuels and sanitary provision.

A relatively small volume of hazardous materials, such as cleaning fluids and solvents, chemicals, lubricants, transformer oils, emergency generator fuels may be present in dedicated storage areas. The management, handling, transportation and use of these materials can introduce risks associated with accidental spills and leaks to ground and impacts to soil quality, with potential (but not expected) indirect impacts to groundwater. However, such instances are considered unlikely as all such chemicals and lubricants will be stored inside structures and buildings with impermeable base and where appropriate with secondary containment. This will ensure that any leaks or spills will be fully contained, resulting in a negligible likelihood of impact to soil, as is the potential for impacts to groundwater which would rely on infiltration through exposed soils.

Inadequate temporary storage and handling of sanitary wastewater prior to being removed for disposal, could also pose a contamination risk, specifically where septic tanks overflow or are not adequately contained.

Table 7-9 Geology, Soils and Groundwater Impact Significance, Mitigation & Management Measures and Residual Impacts – Operation

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Accidental Leaks & Spillage	**Negligible**	Soil Quality	Low	**Minor to Negligible**	• O&M Company will develop a Hazardous Material Storage and Handling Procedure identifying locations of hazardous material storage, storage requirements and handling procedures. • Appropriate training of staff in regard to the handling and response to spill/leak events. • Availability of complete spill kits in place. • Availability of MSDS on-site for any chemicals in use. • O&M Company to ensure that sanitation facilities have effective leak tight plumbing systems and temporary wastewater storages. • Septic/ Collection tanks should be placed in lined pits to ensure spillage is contained. • Collection tanks and associated pipes should be inspected for any leaks or overflow.	**Negligible**

7.6 Monitoring

The minimum expected requirements for the monitoring are outlined in the table below. The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan' as part of the respective construction or operational phases ESMS.

Table 7-10 Monitoring Requirements

MONITORING	PARAMETER	FREQUENCY & DURATIONS	MONITORING LOCATION
CONSTRUCTION			
Soil Quality	Visible spills & leaks of hydrocarbons and other potentially hazardous or chemical pollution sources	Daily visual inspection	The entire Project area during construction
OPERATION			
Soil Quality	Visible spills & leaks of hydrocarbons and other potentially hazardous or chemical pollution sources	On-going monitoring	The entire Project area during operation

8 SOLID WASTE AND WASTEWATER MANAGEMENT

8.1 Introduction

This chapter assesses the Projects expected generation of solid and liquid waste during the construction and operational phases. It does not consider the significance of impacts with respect to a specific receptor (i.e. soil or groundwater quality); as such impacts to soil or groundwater quality with respect to solid and liquid waste have been assessed in the respective section of this ESIA (Section 7 Soil, Geology and Groundwater).

The primary purpose of this chapter is to identify specific management measures in regard to solid waste and wastewater generation that can be adopted in the operational phase ESMS' in order to ensure compliance with applicable regulations and standards

8.2 Standards and Regulatory Requirements

8.2.1 National Requirements

Waste

The Waste Management Regulatory Authority (WMRA) in Egypt is the governing agency for waste management at the national level (established by Prime Minister Decree No. 3005 for 2015). The following laws will be applicable with regards to the management of solid waste generated by the construction and operation of the proposed Project:

- Law No. 38 of 1967 on General Public Cleaning which governs the management of solid waste in Egypt and Presidential Decree Law No.47 of 2014 amending some provisions of Law No. 38 of 1967;
- Law No. 4 of 1994 for the Protection of Environment and the amendments made adding certain clauses increasing the penalties on mishandling of waste, including open burning and dumping in undesignated areas;
- Articles 1, 5, 29, 30 to 33, 85, 88, 95, 99 and 101 to 104 of Law 4 of 1994 and the Executive Regulations for Law 4, Articles 25 through 33 are the relevant articles for management of hazardous waste; and
- The executive regulation Decree 338 of 1995 for Law No. 4 of 1994, Part II includes provision for the management of hazardous waste.

Wastewater

The following laws are applicable for the management of wastewater:

- Law No. 4 of 1994 for the Protection of the Environment, and the executive regulation Decree 338 of 1995, Part III – Protection of Water Environment from Pollution;

- Law No 124/1983 generally prohibits the disposal any industrial wastes, insecticides, and other poisonous and radioactive materials in the Egyptian waters;
- Law No 48/1982 prohibits the discharge into the Nile River and associated waterways, irrigation canals, drains, lakes and groundwater without a licence issued by the Ministry of Water Resources and Irrigation.
- Law 93/1962 sets the conditions for discharging wastewater to public sewer networks;

8.2.2 Lenders Requirements

AFDB

AFDB Operational Safeguard 4 for pollution prevention and control, hazardous materials and resource efficiency established the following requirements for waste management (African Development Bank Group, 2013):

- The borrower or client avoids or, where avoidance is not possible, controls and reduces the generation of hazardous and non-hazardous waste at source, in compliance with applicable international conventions;
- If waste cannot be recovered or reduced, the borrower or client adopts treatment measures and environmentally sound disposal practices;
- At the early stages of the project and in accordance with applicable international treaties and best practices, the borrower or client identifies the potentially hazardous waste to be generated throughout the project's lifecycle to determine cost-effective alternatives for its environmentally sound disposal; and
- If significant production, use or generation of hazardous materials or waste cannot be avoided, the borrower or client, in consultation with potentially affected workers and communities, prepares a management plan in the framework of a lifecycle assessment (transport, handling, storage, recycling and disposal), incorporating management and reporting practices and including preventive and contingency measures.

European (EBRD) Requirements

The EBRD PR3 on Resource Efficiency and Pollution Prevention and Control establishes general requirements waste management as follows:

- The Project must strive to avoid the generation of hazardous and non-hazardous waste materials and reduce their harmfulness as far as practicable. Where waste generation cannot be avoided, the waste must be reused, recycled or recovered, or used it as a source of energy. Where waste cannot be recovered or reused, the waste must be treated and disposed of it in an environmentally sound manner;

- The Project must identify technically and financially feasible alternatives for the environmentally sound disposal of any hazardous waste considering the limitations applicable to trans boundary movement; and
- When waste disposal is transferred offsite and/or conducted by third parties, chain of custody documentation to the final destination must be obtained and only contractors that are reputable and legitimate enterprises licensed by the relevant regulatory agencies must be commissioned. The Project must ascertain whether licensed disposal sites are being operated to acceptable standards. Where this is not the case, alternative disposal options must be considered, including the possibility of developing their own recovery and disposal facilities at the project site.

The European Commission has extensive legislation in regard to solid waste that includes the following:

- Waste Framework Directive 2008/98/EC;
- Hazardous Waste Directive 91/689/EEC; and
- Waste oils Directive 75/439/EEC.

The EBRD PR3 on Resource Efficiency and Pollution Prevention and Control establishes general requirements for minimising water consumption and improving efficiency in its use as follows:

- The Project must seek to minimise water use and utilise water for technical purposes that is not fit for human consumption, where feasible;
- The Project must identify technically and financially feasible techniques for water minimisation, reuse and recycling in accordance with GIP, which should be implemented as part of the project design;
- The Project must consider the potential cumulative impacts of water abstraction upon third party users and local ecosystems; and
- For projects with a high-water demand (greater than 5,000 m^3/day), a detailed water balance must be developed, maintained and reported annually to the EBRD. This should include an assessment of the specific water use (measured by volume of water used per unit production) must be assessed.

IFC

International financial institutions providing project finance will require adherence with the IFC General EHS Guidelines. With regard to waste, these guidelines require that projects:

- Establish waste management priorities at the outset of activities.
- Identify EHS risks and impacts with regards to waste generation and its consequences.
- Establish a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoid or minimize the generation waste materials, as far as practicable.

- Identify where waste generation cannot be avoided but can be minimized or where opportunities exist for, recovering and reusing waste.
- Where waste cannot be recovered or reused, identify means of treating, destroying, and disposing of it in an environmentally sound manner.

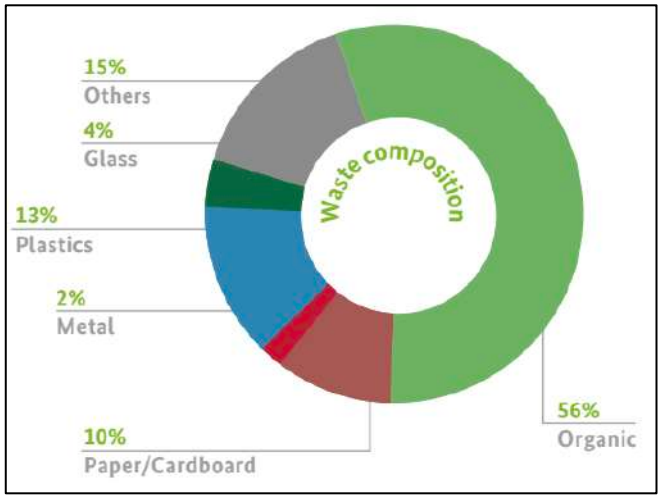
8.3 Baseline

Solid waste generation in Egypt is growing rapidly due to rapid population growth, urbanisation, rapid industrialisation and economic growth. According to the most recent data published by WMRA, the amount of solid waste generated in 2012 was about 89.03 million tons (D-waste, 2014). The estimated composition of the municipal solid waste is shown in the Figure below.

Table 8-1 Breakdown of Solid Waste for the year 2012 – Egypt (D-waste, 2014)

TYPE OF WASTE	QUANTITY (MILLION TONS)
Agricultural waste	30 million tons
Industrial waste	6 million tons
Hazardous medical waste	28,300 tons
Construction and demolition waste	4 million tons
Waterway cleansing waste	25 million tons
Sludge	3 million tons

Figure 8-1 Estimated Composition of Municipal Solid Waste Generated in 2012 – Egypt (D-waste, 2014)



Solid waste management in the country involves activities associated of six basic principles that include waste generation, storage, collection, transfer and transport, processing and final disposal. However, due to lack of awareness, management, education, resources, technology and finance, open dumping, low collection and uncontrolled incineration of wastes is a norm in the country. Approximal 80% to 88% of solid waste generated in Egypt was dumped, 10% to

15% recycled, 7% landfilled and 7% composted for the year 2014. The number of operational landfills in Egypt in 2014 were seven (7). The Table below presents the distribution of dumpsites for the different governorates in Egypt along with the daily generated municipal solid waste in 2012 as published by WMRA. The daily municipal solid waste generated in Aswan in 2012 was 800 tons and total of 15 dumpsites.

Table 8-2 Distribution of Dumpsites and Daily Municipal Solid Waste – Egypt (D-waste, 2014)

Governorate	Generated MSW (tons)	Number of Dumpsites		Governorate	Generated MSW (tons)	Number of Dumpsites	
		Public	Random			Public	Random
Cairo	15,000	5	12	Fayoum	720	5	7
Giza	4,500	1	7	Bani Souwaif	800	2	8
Alexandria	4,000	1	2	Menia	1,300	9	12
Kalyobiya	3,500	5	8	Assiut	700	2	8
Dakahliya	4,500	6	13	Sohag	1,100	11	13
Al Gharbiya	3,500	5	10	Qena	1,080	11	12
Monofiya	2,500	4	14	Aswan	800	5	10
Al-Beheira	3,500	14	16	Luxor	470	2	3
Kafr El-Sheikh	2,500	6	15	Red Sea	450	6	10
Sharqia	2,200	5	10	Matruh	300	8	8
Damietta	1,100	5	12	North Sinai	250	6	8
Ismailia	600	1	7	South Sinai	500	8	10
Port Said	650	1	1	New Valley	100		
Suez	400	1	3				
Total		**60**	**130**	**Total**		**75**	**109**

Most of the generated municipal solid waste generated in many places in Egypt end up dumped in open and public dumpsites. This was observed during the site visit carried out to the Project site and Faris Village in December 2019, by which waste was seen dumped on open land on the sides of Al Ramadi Kebli – Al Raqaba road leading to Faris Village as shown in Plate 8-1/**A**.

Plate 8-1 Waste Management Practises at Project Area – Compilation of Photographs

PHOTOGRAPHS
A- Waste dumped and scattered along Al Ramadi Kebli – Al Raqaba road leading to Faris Village

PHOTOGRAPHS	
	
B- Faris Contractor Union (Waste segregation activities carried out by Contractors for adjacent TSK PV construction site)	
	

According to EEAA, 4 million tons of construction and demolition waste was generated in 2012. The recycling of construction and demolition waste in Egypt is limited and largely carried out informally by traditional waste collectors and recyclers instead. This was observed at the adjacent TSK PV Power Project construction site. Construction waste generated from the site was collected, segregated and compacted by Faris Contractors Union (locals from Faris Village). According to the contractors, the segregated waste will be sent to recycling facilities in Aswan and Cairo. Plate 8-1/**B** above shows photographs of the Faris Contractors Union waste segregation site located 100 m from the north west corner of the Kom Ombo Project site.

Waste Management Disposal Sites

The nearest operational landfill to the project site for the disposal of non-hazardous waste is Wadi Al-Alaki (وادى العلاقى) located Northeast of Aswan city and at a distance of 70km from Kom Ombo and 12 km from Aswan City. A waste recycling facility (Al-Hedaya company) is available in Aswan which is also responsible for the collection of waste in the governorate.

There are no hazardous waste management facilities within Aswan. According to published data, there is only one (1) operational hazardous waste management facility in Egypt located

in Alexandria City approximately 770 km north west of Aswan. Therefore, hazardous waste will be transported and managed at this facility in Alexandria.

8.4 Potential Impacts, Mitigation, Management & Residual Impact

8.4.1 Construction Phase

Solid Waste

During construction, waste will be generated during earthworks, construction of the fences, paths, access roads and buildings.

Typical construction wastes include concrete, asphalt, scrap steel, glass, plastic, wood, packaging materials and domestic waste from construction workers (i.e. relating to food consumption). Concrete may be found in two forms on the construction site; structural elements containing reinforced concrete, while foundations (such as surface level concrete slabs) have mass non-reinforced concrete.

For a solar park, key waste stream will be the packaging of the PV modules. This includes loads of wooden pallets, cardboard, plastic ties and some metal frames. Solid waste generated from construction activities at the Project site will include the following:

- Non-hazardous waste such as;
  - Waste related to construction processes, including earthworks (such as rubble, soils and potentially rock);
  - Paper/cardboard, plastics, packaging, plastic bottles, glass, scrap metal, excess fill materials, sand, gravel, excess construction materials, concrete, subsoil and rock (not contaminated)
  - Domestic waste generated by the construction workforce (e.g. food/organic waste, paper trash, cardboard, aluminium, plastic)
- Hazardous waste such as;
  - Batteries (unused), spend filtration cartridges, chemical drums, oil filters, aerosol cans, contaminated metals, empty containers, expired and unused chemicals, adhesives, machinery lubricants, clean-up materials such as rags, containers and tins with remains of hazardous substances, used spill kits and clean-up materials.
  - Replacement parts from vehicles, plant and equipment such as tyres.

Given the project footprint, the amount of solid waste generated will be of a considerable size. Inappropriate handling, storage, transport and/or disposal of these solid wastes during construction might pose the potential to pollute the surrounding environment (i.e. soil and groundwater resources), cause odour and visual nuisance, encourage pests or result in occupational health and safety issues.

Solid waste streams likely to be associated with the construction phase of the project are listed in the table below.

Table 8-3 Anticipated Solid Waste Types Associated with the Construction Phase

TYPE	WASTE STREAM
Inert	Subsoil and Rock
	Glass
Non-Hazardous	Concrete and cement
	Asphalt
	Scrap metal
	Wood
	Plastic
	Packaging
	Municipal waste from construction workers
Hazardous	Contaminated soil/asphalt
	Resins and paints
	Waste oils
	Waste solvents and thinners
	Waste fuel and chemicals.
	Batteries
	Used spill kits and clean up materials.

Non-Hazardous Solid Waste

Non-hazardous construction waste is typically inert and does not pose a threat to human health or the environment. However, proper management is required in order to reduce associated secondary impacts such as unnecessary resource use, dust emissions, etc.

The majority of the non-hazardous solid wastes generated onsite will be recycled and reused in order to reduce the quantity of waste to be disposed at landfill sites to as low as practicable. The cut fill waste shall be utilised on site as such as possible during the construction period. However, the packaging waste such as cardboard and plastic have the potential to be recycled around the project site area by local businesses.

Hazardous Solid Waste

Due to the nature of the project and the construction works being undertaken, there will be a few hazardous materials used. Such materials may result in fuel containers waste, oily residues, paints, paint cans and wastes from chemical cleaning products.

Although the hazardous fraction of construction waste is expected to represent a relatively small portion of the total amount of construction waste likely to be generated, its management requires careful consideration as the impacts associated with hazardous waste can potentially

result in contamination to soils and potentially groundwater, as assessed in the geology, soils, hydrology and groundwater sections of this ESIA.

Inappropriate management, storage, handling, transfer or transportation through lack of personnel training on site may lead to accidental spills or leaks to the soil or groundwater resulting in environmental impacts and potential health risk to workers. Contamination events may also arise as a result of transportation by unlicensed waste contractors or disposal to unlicensed/unauthorised landfills. Waste management strategy and planning is therefore critical in order to minimise potential significant effects on sensitive receptors such as soil and groundwater. All waste management practices must be in line with the prescribed requirements of the CESMP and/or site waste management plan to be enforced and updated as necessary by the contractor.

There are no licensed hazardous waste treatment facilities currently available in Aswan or any nearby city. Therefore, waste generated by the Project will most likely be transported by road vehicles for a long distance to the hazardous waste facility in Alexandria (approximately 770 km). Therefore, it will be particularly important to properly store the waste in designated and secured hazardous waste storage areas at the site until collection to final disposal. These areas will include bunds to contain spillages, secure fencing to control access, proper safety signage, a roof structure to prevent rain water entering, etc.

Liquid Waste/Wastewater

Wastewater generated from construction activities at the project site will include the following:

- Sanitary and domestic wastewater generation;
- Wastewater from any vehicles or equipment washing/cleaning
- Liquid hazardous waste such as fuels, chemicals, paints, lubricants, solvents, waste oil, hydraulic fluid, resins, waste solvents and thinners, etc.; and
- Storm water runoff events on site and.
- Concrete washout.

For sanitary and domestic wastewater, it is anticipated that there will be a significant number of workers at the peak period of construction. The quantities of sanitary and domestic wastewater can be estimated as an average of 0.1m^3/person/day (100 litres). Assuming the estimated number of construction workers during peak periods will be up to 1000 personnel, sanitary wastewater is estimated to total 100 m^3 at peak periods of construction. Wastewater generated on-site will be stored within septic tanks for removal by a licensed wastewater contractor.

It should be noted that the figure of 100 litres/worker/day relates to overall water consumption including at accommodation areas. Such wastewater will be stored within septic tanks on-site, prior to removal by a licensed contractor. Improper handling, storage and transportation of

sanitary and domestic wastewater could potentially cause contamination to soil or groundwater resources; as assessed in the Geology, Soils, and Groundwater section of this ESIA.

Storm water is not expected to occur on a regular basis due to the climatic condition of Egypt and minimal rain in Aswan. However, when rainfall occurs, storm water may runoff into areas containing hazardous materials and either leach these into the soil, flow to the runoff areas or carry these off the site, potentially contaminating soil, the runoff areas and reaching the groundwater.

8.4.2 Waste Characterization

Waste can exhibit certain characteristics according to the process stream from which it is generated and any pre-treatment processes that are undertaken. Different types of waste require different management and disposal techniques according to the potential risk that the material poses to human health or the environment. For the purpose of this Project, waste has been classified into three (3) main categories below.

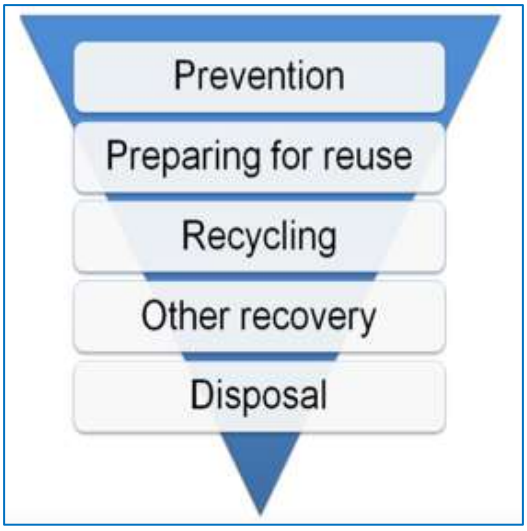
Table 8-4 Waste Characterisation

WASTE CLASSIFICATION	DESCRIPTION
Domestic Waste	Household, commercial, agricultural, governmental, industrial and institutional wastes, which have chemical and physical characteristics similar to those of household such as garbage, paper, cardboard, plastic, cans, etc. Disposal of such waste can generally be routed to municipal recycling or disposal facilities.
Industrial Waste	Non-hazardous wastes that have physical and chemical characteristics that are different from domestic wastes such as construction waste, glass, scrap metal, wood, used containers, tyres etc. This waste generally poses little risk to the environment and can be disposed to normal municipal facilities after waste minimisation options are exhausted and prior obtaining approval
Hazardous Waste	Waste is classified as being hazardous because of its concentration; physical, chemical or infectious characteristics, which may pose a present or potential threat to human health or the environment and/or may cause an increase in serious irreversible or incapacitating reversible illness or contribute to an increase in mortality. In accordance with the Basel Convention, hazardous waste is any waste (i.e. solid, liquid or gaseous) having the following properties: • Explosive; • Radioactive (which includes NORM (LSA) scale); • Ignitable or flammable substances; • Poisons with acute and chronic (delayed) toxicity; or • Substances that by interaction with water might become spontaneously flammable or give off flammable gases. • Hazardous waste must be segregated, stored, transported and ultimately treated and disposed by approved waste services provider.

8.4.3 Waste Management Hierarchy

The waste management hierarchy illustrates best practice for waste management considerations by ensuring consideration of the most sustainable available application for waste management in preference of disposal and eventual contribution to adverse environmental and economic impacts associated with landfill. The hierarchy as illustrated below should form a key element of any waste management strategy and if implemented effectively will achieve maximum reductions on waste quantities combined with the limited use of resources and fill space. The waste management hierarchy also has the potential to reduce costs that may be incurred by the main contractor or the proponent for handling, transportation and the disposal of waste.

Figure 8-2 Estimated Composition of Municipal Solid Waste Generated in 2012 – Egypt (D-waste, 2014)



Initially, options to prevent or reduce waste should be considered. Where waste generation cannot be avoided or further reduced at source, opportunities for reuse of materials should be explored, either for use for the same or a different purpose. Disposal to landfill is the least favoured option in the waste hierarchy and is the last resort after all other options have been considered.

Table 8-5 Waste Impact Significance, Mitigation & Management Measures and Residual Impacts – Construction

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Inappropriate handling, storage, transport and disposal of non-hazardous solid waste	**Minor**	Soil, Groundwater & surrounding environment	Medium	**Minor**	• The project will develop and implement a Project specific Construction Waste Management Plan (CWMP) in line with committed mitigation measures in this ESIA report and the provisions of the CESMP. • Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling and reuse. • Waste containers/skips should be clearly labelled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce. • For litter (food waste, domestic waste), an adequate number of covered bins should be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. • Food waste must be stored within a sealed metal or plastic skip or bin, in order to prevent pests gaining access. • On-going housekeeping training should be provided to all staff on the importance of the need to avoid littering. • Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all lightweight material that could be blown away. • Waste generated during construction will be recycled and reused until reduced to as low as practicable prior to collection for disposal	**Negligible to Minor**

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
					by an appropriately licensed waste contractor. • Only licensed waste transporters and waste management facilities will be engaged. • Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments • Completed waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal. All records will be maintained on site. • Mandatory training program for employees to increase their awareness of waste management protocols including proper handling and storage of waste, recycling waste, reusing plastics, rebar, wood & other reusable non-hazardous materials.	
Inappropriate/uncontrolled handling, storage, transport and/or disposal of solid hazardous waste	**Moderate**	Soil, Groundwater & surrounding environment	Medium	**Moderate**	• Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments. • Segregate and identify hazardous waste from the other waste streams into separate waste containers/skips clearly signed and labelled. • Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits and spill response procedures. This area must be placed away from any sources of ignition. • Hazardous waste storage area should be constructed away from drainage system and	**Minor**

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
					a rain shelter to avoid any potential instance of runoff, or leakage of runoff. • Waste containers should be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce. Wherever possible, chemicals will be kept in their original container. • Hazardous waste storage areas will be located away from any ignition sources or fire hazards.	
Inappropriate/uncontrolled handling, storage, transport and/or disposal of sanitary wastewater	**Minor**	Soil, Groundwater & surrounding environment	Medium	**Minor**	• Contractor to develop and implement a Project Specific Construction Waste Management Plan (CWMP) in accordance with committed mitigations measures in this ESIA report and provisions of the CESMP. • Develop and maintain a hazardous waste inventory to document and track sanitary waste generated and segregated. • Sanitary wastewater tanks should be placed in allocated impervious hard standing areas with bonding capacity to hold 110% volume of the maximum volume stored. • Sanitary wastewater tanks to be properly maintained and inspected to ensure tanks do not overflow. • Site inspections will be carried out regularly by the EPC contractor to ensure that all wastewater generated is properly managed, and no leakages or spill occur. In the event of a spill or overflow, immediate action will be taken in accordance with spill containment procedures and clean up procedures (to be developed in line with the CESMS). • Engage a licensed waste contractor for the periodic removal of septic tanks.	**Negligible to Minor**

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
					• In common with the lender requirements for resource efficiency, effort will be made in training construction personnel to minimise water consumption for ablutions and to ensure an understanding of water resource and wastewater issues.	
Waste Transport and Disposal	**Moderate**	Air atmosphere and Soil, groundwater & surrounding environment	Medium	**Moderate**	• Care will be needed when loading/unloading wastes on trucks to prevent spillages. • Waste should be contained at all times and appropriate precautions to avoid waste escaping to the air. • Identify responsible licensed waste disposal sites within Aswan or as close as possible to minimize transportation impacts. • Implement a waste minimization strategy across all aspects of construction site.	**Minor**

8.4.4 Operational Phase

The operational phase of the PV Project will result in the production of few waste streams from the maintenance activities, with the vast majority of these streams being non-hazardous. Nevertheless, if these waste streams are not managed and disposed of effectively, they could result in significant impacts upon the surrounding environment (i.e. soil and groundwater resources).

Solid Waste

Solid waste is not expected to be generated in significant quantities during the operational phase of the PV Plant, besides maintenance for PV Panels, transformers, and general day-to-day maintenance activities of administration facilities. Similar to the construction phase, there are no hazardous waste management facility in Aswan. The only licensed and operational facility for hazardous waste is located in Alexandria (approximately 770 km from Aswan). However, the volumes of hazardous waste during the operation phase is most likely to be insignificant. Proper storage provisions until disposal will be required as outlined in the mitigation measures below.

Non-Hazardous Solid Waste

The operation of the proposed Project will generate small amounts of non-hazardous domestic waste from the operation of the administration facilities and from activities of the employees.

This waste can be classified as both recyclable and non-recyclable. Recyclable waste includes paper, tin cans, plastics, cartons, rubber, and glass, while non-recyclables will consist mainly of food residues and other organic wastes. The quantity of domestic waste will be small given the few anticipated personnel required to operate the PV plant. Other solid non-hazardous waste generated during operation will be landscaping waste and uncontaminated replacement parts and packaging.

Hazardous Solid Waste

This fraction of the waste streams can potentially cause significant adverse impacts on human health and the environment if inadequately managed.

Examples of likely hazardous waste streams that may arise during the operation of the Project include the following:

- Used chemical containers and drums;
- Soil contaminated by potential spills and leaks of hazardous materials/liquids and used spill kits and clean up materials;
- Miscellaneous wastes such as batteries, waste cables, oily rags, etc.;

- General clean-up materials and solvents from general maintenance of on-site plant and machinery.

Inappropriate handling of hazardous waste streams through lack of personnel training on site may lead to accidental release of hazardous waste contaminating soil or groundwater. Contamination may also arise as a result of poor-quality waste transporters and waste management facilities, or lacking capacity of these services locally. These risks may consequently result in illicit waste disposals (e.g. fly-tipping, or waste disposal at unlicensed locations), or the engagement of unlicensed contractors/facilities.

Liquid Waste/ Wastewater

Liquid waste generated from operational activities at the Project site will include the following:

- Sanitary and domestic wastewater generation from operation and maintenance staff working in the PV plant;
- Oily Water (to collect spills/leaks from transformer areas) if any will be in very small quantities;
- Liquid hazardous waste (if any) such as fuels, chemicals, paints, lubricants, solvents, waste oil, hydraulic fluid, resins, waste solvents and thinners, etc.; and
- Storm water runoff events on site.

Sanitary and domestic wastewater will be generated directly from site toilets and kitchen facilities. All sanitary streams will be directed to the septic tank for collection and disposal by a licensed contractor.

Any oily wastes from the transformer area, or other floor drains in oily areas, will collect oily water in a sump and will be treated in an oil separator for settlement of solids. The residual oil and solids will be collected for recycling and/or disposal by a licensed contractor. The OESMP will identify waste treatment/disposal sites as close as possible to Project site and Aswan to minimize transportation impacts.

The improper handling, transport and disposal of hazardous wastes could lead to potential localised contamination of soil and groundwater resources, which have been assessed for significance in the 'Geology, Soil, Hydrology and Groundwater' section of this report.

Storm water has the potential to run off into areas containing hazardous materials and either leach these into the soil, flow into wadi channels or carry these off the site, potentially contaminating soil and possibly reaching groundwater resources. However, heavy rainfall is extremely rare in Aswan.

Table 8-6 Waste Impact Significance, Mitigation & Management Measures and Residual Impacts – Operation

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Inappropriate handling, storage, transport and disposal of non-hazardous solid waste	**Negligible Adverse**	Soil, Groundwater & surrounding environment	Medium	**Negligible to Minor**	• The O&M Company are to develop and implement a Project specific Waste Management Plan (WMP) in line with committed mitigation measures in this ESIA report and the provisions of the OESMP. • Training will be provided to employees to ensure awareness of waste management including proper waste; training and orientation on waste minimisation, segregation and good housekeeping practices. • Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling. • Waste containers/skips should be clearly labelled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce. • For litter (food waste, domestic waste), an adequate number of covered bins should be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. • Food waste must be stored within a sealed metal or plastic skip or bin, in order to prevent pests gaining access. • Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all	**Negligible**

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
					lightweight material that could be blown away. • Paper cardboard, metal cans, plastic, glass to be collected for recycling by a licensed waste contractor. • Only licensed waste transporters and waste management facilities will be engaged. • The Contractor will maintain copies of the waste management licensed on site. • Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments • Completed waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal. All records will be maintained on site.	
Inappropriate/uncontrolled handling, storage, transport and/or disposal of sanitary wastewater	**Negligible Adverse**	Soil, Groundwater & surrounding environment	Medium	**Negligible to Minor**	• Sanitary facilities should be provided with adequately designed underground storage tanks. • Sanitary wastewater tanks to be properly maintained and inspected to ensure tanks do not overflow. • Sanitary wastewater tanks in allocated impervious hard standing areas with bunding capacity of 110% volume of the maximum volume stored. • Sanitary wastewater treated at the onsite sewage treatment plant must meet established discharge limits prior to discharge. • Only licensed waste contractor will be engaged for the periodic removal of tank.	**Negligible**

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Inappropriate/uncontrolled handling, storage, transport and/or disposal of solid hazardous waste	**Negligible Adverse**	Soil, Groundwater & surrounding environment	Medium	**Negligible to Minor**	• Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments. • Segregate and identify hazardous waste from the other waste streams into separate waste containers/skips clearly signed and labelled. • Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition. • Waste containers should be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required by the workforce. Wherever possible, chemicals will be kept in their original container.	**Negligible**

8.5 Monitoring

The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan'.

Table 8-7 Waste Management Monitoring Requirements (Construction and Operations)

MONITORING	PARAMETER	FREQUENCY & DURATIONS	MONITORING LOCATION
Inspect and monitor proper handling and storing of waste materials	Check storage areas containment and control procedures as per CESMP/OESMP	Daily	Storage areas
Inspect and monitor third party waste contractors and disposal facilities	Ensuing engaged contractors, their vehicles and waste management facilities have applicable registrations/licenses at time of procurement	At procurement and annually thereafter	Contractors, transport vehicles and waste management facilities
Waste Transfers	Record keeping of waste transfer notes	On-going	As waste is transferred

9 TERRESTRIAL ECOLOGY

9.1 Introduction

This chapter assesses the potential impacts and effects on the terrestrial ecology that may occur as a result of the projects construction and operational activities and identifies the measures that will be undertaken and implemented in order to mitigate these impacts.

9.2 Standards and Regulatory Requirements

9.2.1 National Requirements

Annex 5 of the Ministerial Decree 338/1995 amended in 2005 on promulgating the Executive Regulations of the Environmental Law No. 4 of 1994 for the Protection of the Environment establishes the requirement for the prohibition of hunting, killing or capturing of wild birds and animals. This includes:

- Any other birds or animals determined in the international conventions to which the Arab Republic of Egypt adheres to; and
- Any other birds or animals designated in a decree to be issued by the Minister of Agriculture in agreement with the EEAA.

In addition to the above, Law No 102 of 1983 for Nature Protectorates prohibits the destruction or deterioration of the natural environment. The Law defines a natural protectorate "as any area of Land, or coastal or inland water characterized by flora, fauna, and natural features having cultural, scientific, touristic or aesthetic value. These areas will be designated and delineated by Decree of the Prime Minister upon the recommendation of the Egyptian Environmental Affairs Agency." -n particular, the following acts are forbidden:

- Catching transporting killing or disturbing wildlife;
- Damaging or removing any living organisms or natural features and resources, such as shells, corals, rocks, or soil for any purpose;
- Damaging or removing plants (from) the protected areas:
- Spoiling or destroying the geological structures (and other features) of areas serving as natural habitats and breeding areas for plants and animals;
- Introducing foreign (non-indigenous) species of biota into the protected area; and
- Polluting the soil, water, or air of the protected areas in any manner.

In addition to the above, Law No. 53/1966, the Agriculture Law offers Species protection mainly for birds beneficial to agriculture, but also those which are globally threatened.

9.2.2 Lender Requirements

European (EBRD) Requirements

Similar requirements exist under EBRD PR6 which would need to be complied with if EBRD are providing project finance. The EBRD PR6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources establishes general requirements for the conservation of biodiversity and sustainable management of living natural resources covering aspects such as the assessment of issues and impacts on biodiversity.

Where applicable, the Project will intend to follow the targets set out by the EU Biodiversity Strategy including the Habitats Directive 92/43/EEC, the Birds Directive 2009/147/EC and the EU Regulation 1143/2014 on Invasive Alien Species. It is noted however that the targets are unlikely to be triggered by the Project due to the existing ecological conditions within the Project site.

IFC/ World Bank Requirements

The assessment of impacts upon terrestrial ecology will be made with due reference to the IFC Performance Standard 6 on Biodiversity Conservation and Sustainable Natural Resource Management which establishes requirements for protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources. When avoidance of impacts is not possible, measures to minimise impacts and restore biodiversity and ecosystem services should be implemented. Specifically, it is necessary to determine baseline conditions and categorise the projects habitats as 'critical', 'modified' or 'natural' to undertake the necessary assessment. The Performance Standard defines the different habitats as follows:

- Natural Habitat: "Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition";
- Critical Habitat: "Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes"; and
- Modified Habitat: "Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed6 coastal zones, and reclaimed wetlands".

AFDB

AFDB requirements for biodiversity and ecosystem is listed under OS 1 and OS 3. As part of AFDB requirements, potential impacts on biodiversity and ecosystem from a Project should be assessed and appropriate mitigation and other management measures to be implemented. AFDB OS 3 requires borrowers to identify and assess the potential opportunities for risk to, and impacts on local biological diversity and ecosystems. The objectives of OS 3 are to:

- Conserve biological diversity and ecosystem integrity by avoiding or, if not possible, reducing and minimizing potentially harmful impacts on biodiversity and associated ecosystems;
- Endeavour to reinstate or restore biodiversity including, where required, the implementation of biodiversity offsets to achieve "no net loss but net gain" of biodiversity in cases where some impacts are unavoidable;
- Protect natural, modified and critical habitats; and
- Sustain the availability and productivity of priority ecosystem services to maintain benefits to the affected communities and to sustain the project's development objectives and overall performance.

AFDB defines the different habitats as follows (African Development Bank Group, 2013):

- Natural habitats: habitats with original populations of native flora and fauna whose species composition, richness and abundance have not been modified by human activities';
- Modified habitats: habitats whose primary ecological functions have been significantly altered by human activities and whose original species composition, richness and abundance have been reduced, with evidence of colonisation by non-native species of flora and fauna.
- Critical habitats: natural or modified habitats that have a high biodiversity value; they include the following:
  - Habitats important to critically endangered and footprint impacted species;
  - Habitats of significant importance to endemic and/ or restricted-range species and subspecies;
  - Habitats of significant importance to globally significant concentrations of migratory species and/or congregatory species;
  - Regionally significant and/or highly threatened or unique ecosystems;
  - Areas that are associated with key evolutionary processes;
  - Areas that are important to species that are vital to ecosystems, such as keystone species; and
  - Areas that supply ecological networks.

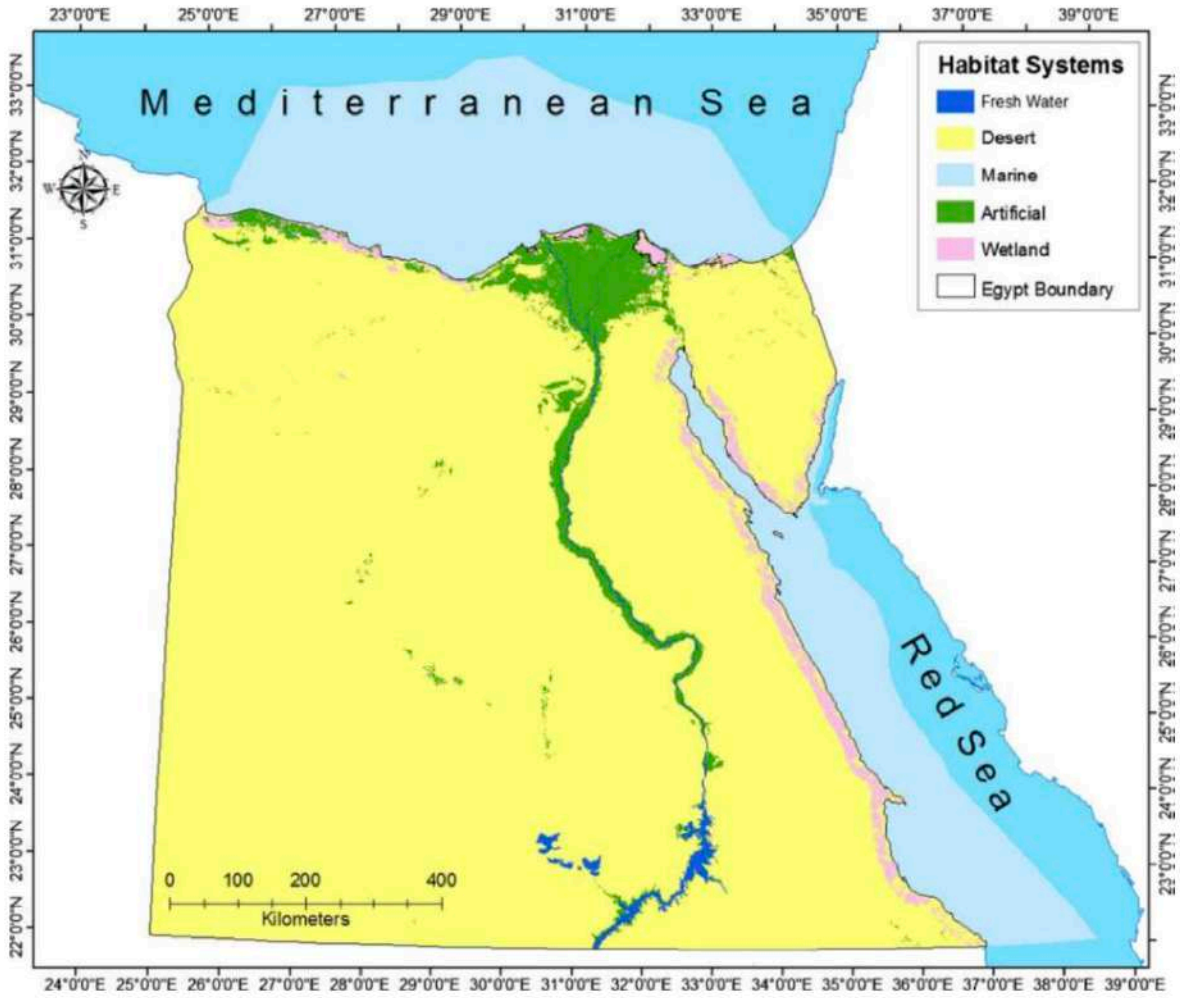
9.3 Baseline

9.3.1 Regional Conditions

Based on the Convention on Biodiversity (CBD), approximately 92% of the land in Egypt is composed of desert and only 8% is agricultural land (8%) (Cbd.int, 2020). There are five (5) main habitat systems in Egypt as follows (Ministry of Environment, 2016):

- Desert habitat;
- Marine habitat;
- Wetlands habitat system;
- Artificial habitat; and
- Fresh water habitat.

Figure 9-1 Habitat Map of Egypt (Ministry of Environment, 2016)



Many of the flora and fauna in the desert habitat in Egypt are considered of ecological importance, especially in Sinai area (i.e. 324 species of fauna). Wetlands are also considered

an important ecosystem, with 80 plants, 100 animals and 82 fish, notably along the Nile, spread over 1,530 km of the national territory (Cbd.int, 2020).

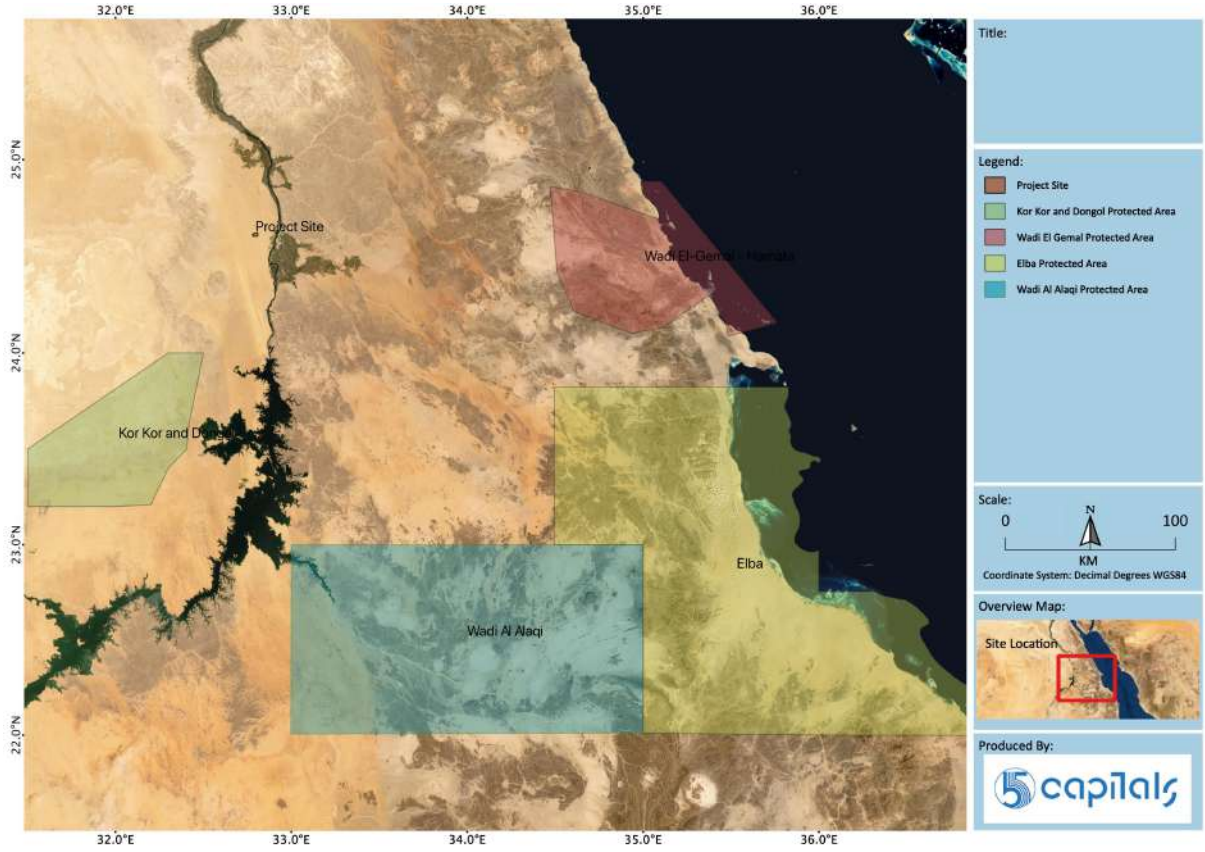
Overall, Egyptian biodiversity comprises 143 types of globally important species, 800 species of non-flowering plants, 2,302 flowering plants, 111 species of mammals, 480 species of birds, 109 species of reptiles, 9 species of amphibians, and more than 1,000 species of fish (Cbd.int, 2020).

Based on the most recent data published for Egypt biodiversity profile by CBD, there are 51 species of mammals already endangered, along with 26 bird species and 26 reptile species (Cbd.int, 2020).

According to the Map of Life 2020, which assembles and integrates data from different sources such as IUCN, WWF and GBIF, there are 370 birds, 124 mammals, 51 reptiles, 4 turtles, 8 amphibians, 24 Sphingid moths, 36 dragon flies and 3 conifers recorded in Egypt (Mol.org, 2020).

According to Protected Planet, a World Database on Protected Areas (WDPA), there are 50 protected areas in Egypt. The protected area covers approximately 13.14% of the country's land and 4.95% of its marine (UNEP-WCMC, 2020). The nearest protected areas to the Project site are Kor Kor and Dongol to the south west (72 km), Wadi Al Alaqi (178 km) and Elba (193 km) to the south east and Wadi El Gemal – Hamata to the east (170 km). The project is too far from these areas to have any effect on them. Locations of protected areas are shown in Figure below.

Figure 9-2 Protected Areas in Egypt (Protected Planet, 2020)

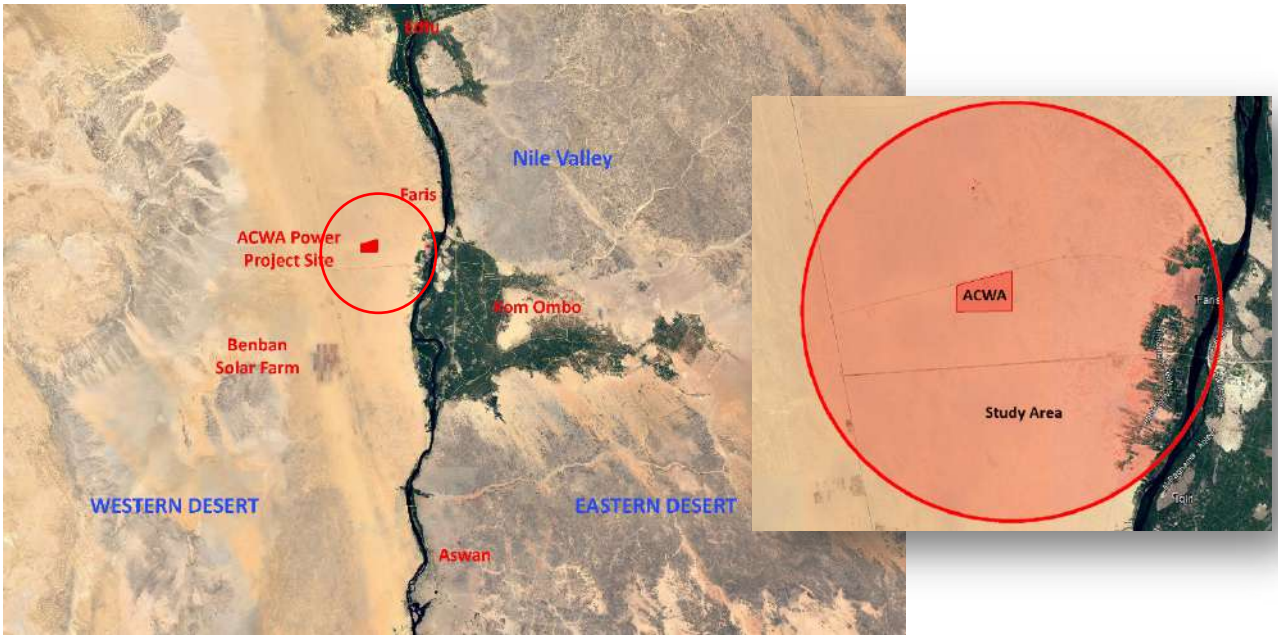


9.3.2 Project Site and Surrounding Area

Terrestrial Ecology Survey Methodology

The terrestrial survey covered the Project footprint and a wider study area extending several kilometers in each direction around the Project Site (see Figure below). The Study Area covered approximately 300 km^2 and extended from Nile's western bank fronting Faris Village to the Luxor – Aswan Western Road and about 10 kilometers into each of the desert area north and south of the site. The study area was selected subjectively, but based on the "minimal area approach" for sampling habitat types within the general area. The minimal area is here defined as the plot size beyond which an increase in plot size does not result in a significant increase in the number of detected habitat types.

Figure 9-3 The ecological survey Study Area and the Project site



Available secondary data specifically covering the Project Site or the Study Area is lacking in the scientific literature. Considerable secondary data, however, are available on the nearby but very similar area of the Benban solar farm. In addition, significant data is available on the Kom Ombo area within the larger geographical context of the southern region of the Western Desert of Egypt. Field survey was therefore, designed to collect site-specific data and to verify information available from the more "coarse grain" studies covering the south-eastern region of the Western Desert.

Survey Techniques

The overall goal of this task has been to assess the existing environmental conditions at the project area based upon a combination of available secondary data and field surveys. The desktop review of secondary data consisted of thoroughly reviewing and analyzing all available data on the general area of the project as well as the proposed solar farm site proper. Reviewed material included reports, maps, topographic survey data, satellite images, climatic data, watershed analysis data, etc. Guided by the findings of the desktop review of available reports, maps and satellite imageries, field survey was planned and implemented to identify the structural and functional characteristics of available habitats and their biota in the area. Similarly, studies of the geomorphologic and geological settings of the area, which provides the baseline setting, are based upon the use of both remote sensing data and ground reconnaissance as described elsewhere in this report.

Survey of the habitat types at the regional scale was initially based upon the Egyptian national habitat type classification (Saleh, 1993) and review of satellite imageries data, but subsequently verified by field survey. Initial reconnaissance of the site and the surrounding area

showed that the area is mostly barren, and life is restricted to small patches of vegetation of extremely low diversity and their associated fauna typical of extreme desert environment. Field survey covered, in addition to the Project Site, the surrounding desert area. It also covered the locally mesic habitats in the Nile Valley and the irrigated land in the vicinity of the Faris Village.

Biodiversity was assessed at the habitat and species levels. Vegetation cover, resident and transient fauna, including reptiles, birds and mammals, some invertebrates and their ecological relations were surveyed and described. The surveys identified key terrestrial biodiversity present at or near the area of the proposed solar farm, including endangered and protected species, if any, that may be impacted by the proposed development.

Location, structure, composition and type of plant communities were recorded whenever any significant natural vegetation cover is encountered. Data on the occurrence of vegetation cover, type of land surface sediments and elevation was recorded on geotagged images taken every 50 meters along a number of parallel belt transects using two GPS cameras mounted on a vehicle. The belt transect was 100 m wide and ran across the entire project site from north to south. In addition, photographic records of habitat types elsewhere in the study area were obtained and stored in geo-referenced electronic format. Plant species identification followed the taxonomic keys of Boulos (2005). Identification of plant communities followed the description given by Zahran and Willis (2009) and Zahran (2010). Habitat types were identified according to the system developed by the Egyptian National Biodiversity Unit (Ayyad and Ghabour, 1993; Saleh, 1993).

Animal species sampling was carried out at the project site and several localities in the nearby Nile Valley where relatively important habitats are located. Indicators of biodiversity in the form of mammals, birds, reptiles, scorpions and tenebrionid beetles were used to assess animal species richness. Seasonal changes in the occurrence or abundance of certain elements of the biota could not covered since the survey spans only one season.

Reptiles were captured by hand after following their tracks or dug out of their burrows. Identification was according to the keys of Saleh (1997). Observations on the avifauna were made using field glasses and identification was verified using appropriate field guides. Both resident breeders and migratory species were identified and recorded. We searched for evidence of nesting, foraging or roosting at or near the project site.

Folding, Sherman live traps were used to sample trap rodents. Captured animals were identified and subsequently released at the point of their capture. The occurrence of small carnivores such as foxes and smaller cats was detected based on their tracks in the sand or direct observation. Based on the results of this survey, assessment of biodiversity elements (habitat, species and genetic diversity) of key conservation importance are identified. Scorpions and beetles were collected using pitfall traps and active search with UV light. Specimens' identification was carried out using taxonomic keys (Badry et al. 2018) and comparison with museum material as necessary.

Findings

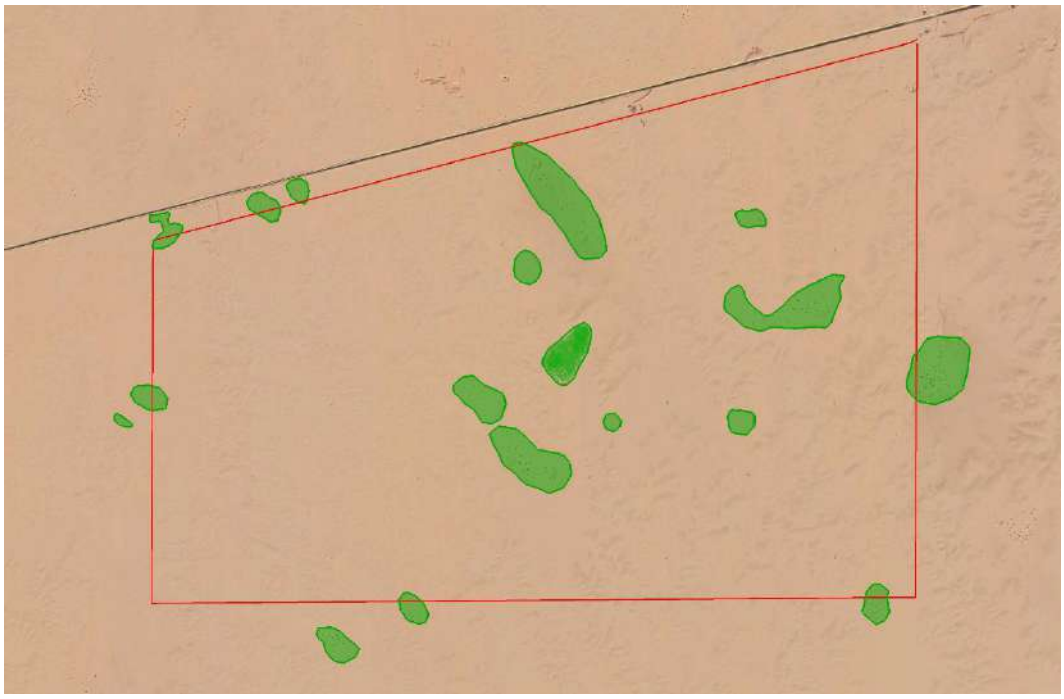
Habitats and Flora

Typical of all desert regions, habitats of the Project Site and the Study Area are limited in diversity and coverage. Habitable areas, even for the most hardy desert species, are restricted locations that have certain topographic features, which allow adequate moisture to be available at or near the ground surface. The Project Site and the surrounding desert land is mostly barren and supports a very little permanent animal and plant life.

Uni-specific patches of the shrub *Salsola imbricate,* scattered throughout the site represent the only vegetation cover in the area.

Figure 9-4 *Salsola imbricate* vegetation patch at the project site

Figure 9-5 Distribution of *Salsola imbricate* vegetation patched at the project site



Plants in these patches are thinly distributed and vary in heights between 50 cm up to about 150 cm. Several individual plants may grow together forming dense thickets that may reach more than 5 meters in diameter. Individual plants trap wind-blown sand forming phytogenic mounds of a moderate height, usually less than one meter. No other plants are found within the boundaries of the site and the surrounding desert.

Salsola imbricate is a very common plant throughout hyper-arid areas of the deserts of Egypt. Most often, it is the only plant encountered in the interior of the Western Desert. The distribution of the *Salsola imbricate* patches at the project site is shown above. All of the animal species recorded from the area came from the *Salsola imbricate* patches.

Ecological features of the site was surveyed along 14 transects across the site. The transects varied in length between 1. to 1.9 km and run across the project site from north to south. The distribution pattern of the *Salsola imbricate* patches cannot be correlated to any obvious attributes related to topography or the nature of surface sediments (**Error! Reference source not found.**). This, coupled with the lack of surface drainage lines of any sort run through the site or the nearby area, suggests that local precipitation plays very little role, if any in providing the water needs for these plant and their associated animal communities.

Vegetation cover in the desert area surrounding Project Site is extremely sparse and restricted to the stands of *Salsola imbricate* similar to those found within the project site. No other species of plant was observed on the site or in the adjacent desert area.

The Nile Valley and the reclaimed desert land immediately west of it, are intensively cultivated with a variety of crops and fruit orchards. Except for weeds associated with agricultural crops, no wild vegetation is found in that area and no pristine habitats of any kind remain. The area has been fundamentally modified by human activities for thousands of years.

The *Salsola imbricate* habitat patches at the project site and the surrounding desert represent the only natural habitat in the area. These patches of vegetation and their associated fauna seem to be largely pristine, since the area, like most of the Western Desert interior has not been much affected by human activities. This type of natural habitats, however, is widespread throughout most of Egypt and is not considered in any way restricted or critical.

Habitats in the Nile Valley and the reclaimed desert to the east of the project site are largely anthropogenic. Although utilized by a variety of plant and animal forms, these densely populated, intensively cultivated modified habitats hold most of the biodiversity of the area. No threatened or restricted biodiversity (habitats and species) have been observed in these areas.

Fauna

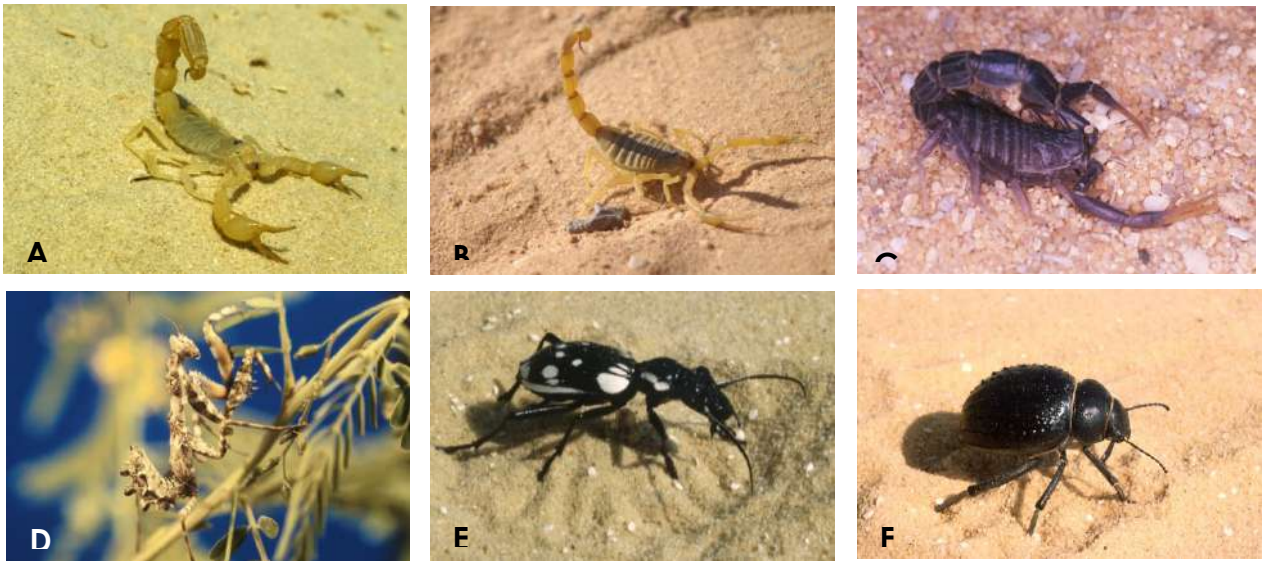
Wild fauna of the Project Site is limited to few insects and other arthropods, reptiles, occasional birds and small mammals. Transient species are restricted to birds and insects, and represent a relatively low diversity of species.

Invertebrates

Invertebrate fauna of the project site is typical of that of the shallow sandy habitats of the Western Desert. Insects form the most diverse and numerically abundant invertebrate fauna in the project area. Insects belonging to orders Coleoptera, Homoptera, Hemiptera, Hymenoptera, Orthoptera, Lepidoptera, Neuroptera, Thysanura, Isopterta, diptera and Dictyoptera are represented at the *Salsola imbricate* habitats in the project site and the neighboring areas.

Arachnids including scorpions, spiders and ticks were recorded in the Project Site and nearby areas. Three scorpion species have been recorded in this part of the Western Desert; namely *Androctonus australis, Leiurus quinquestriatus* and *Orthochirus aristidis*. Only one species; *Orthochirus aristidis* was actually observed during this survey.

Figure 9-6 Scorpions and insects recorded/observed at the Project Site and adjacent areas



A. *Androchtonus australis*, B. *Leiurus quinquestriatus*, C. *Orthochirus atarensise*, D. a desert praying mantis (order Mantodea); E. *Anthia sexmacullata*, F. *Pimelia ungulate*.

Although the invertebrate fauna of the project site was not fully explored during these studies, particularly in terms of composition and abundance, it may be concluded that none of the observed invertebrates is considered threatened either locally or internationally. All of the species recorded at the site are common throughout the greater part of the Western Desert.

Reptiles

Reptiles are the most diverse vertebrate group in the desert part of the Study Area, and consist entirely of species typical of the extreme desert. Most of this herpetofauna is composed of lizards and snakes that are adapted to sandy desert habitats. A total of 13 species are known to occur in the general area and can potentially be found at the project site (Saleh, 1997). The table below shows a list of reptiles observed at the Site and the adjacent desert. These species represent four lizard families (10 species) and two snake families (four species). Among these potentially occurring species, five lizard species and two snake species were observed at the site. The density of reptile species recorded at the Project Site appears to be very low. During four days of working at the site, a total of 12 individual reptiles were seen. It is very likely, however, that much more individuals will be active on the ground surface during wormer times of the year. The following figure shows examples of reptiles of the Study Area.

All the species in the table below are common throughout the Western Desert of Egypt. The three snakes of the family Colubridae are among the more common, non-venomous snakes of Egypt, being widespread throughout the country. The snake family Viperidae is represented

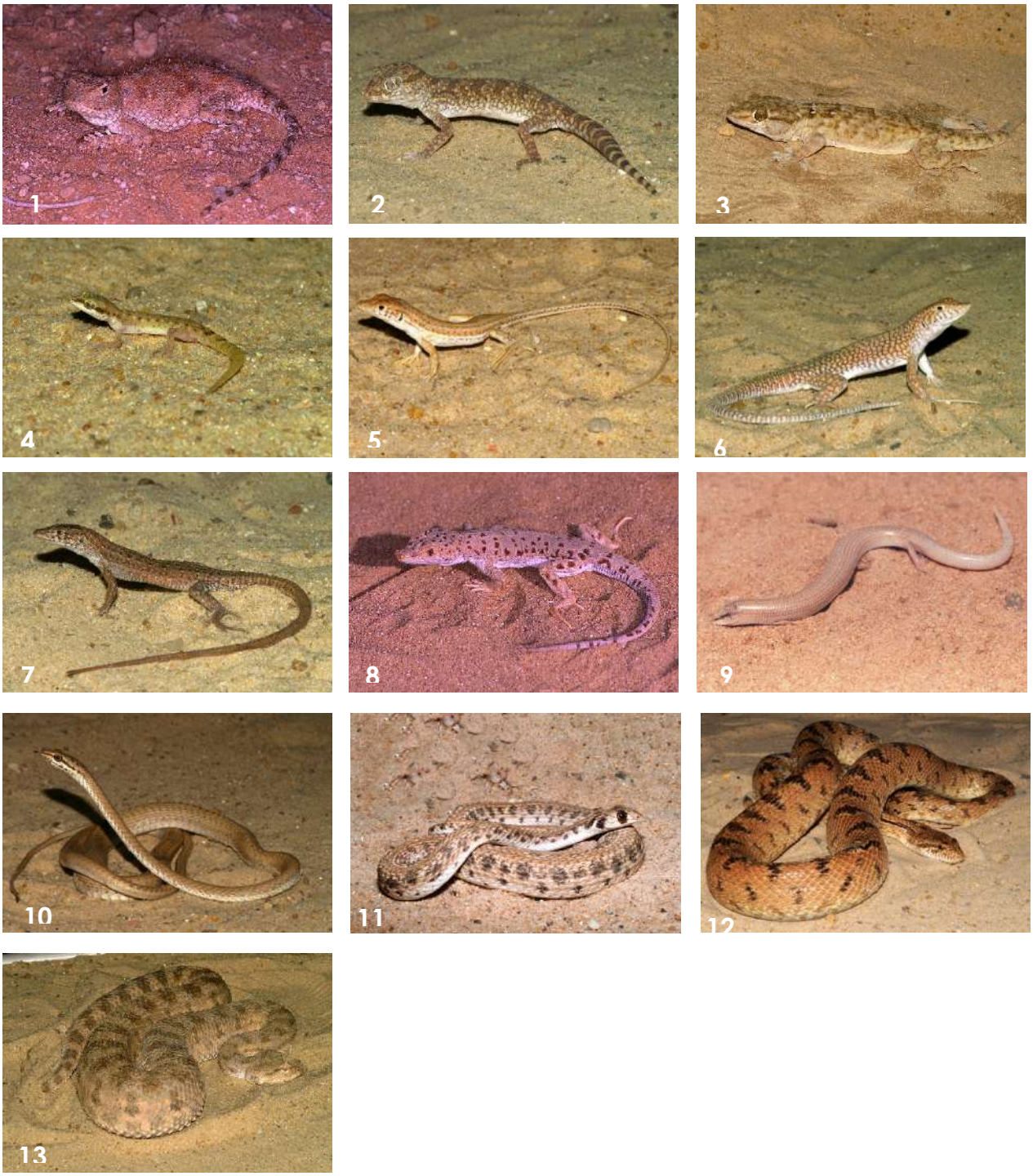
in the general area by one species of venomous snakes. The Horned Viper *Cerastes cerastes*, was actually encountered in the Project Site during this survey.

All the reptile species recorded from the area or those that are likely to occur in the area, are listed as Least Concern in the IUCN lists of threatened species. The development of the site is, therefore, not expected to significantly impact the herpetofauna of Egypt or any threatened species.

Table 9-1 Reptiles observed at the Project Site during this field survey and those that are likely to occur in desert habitats in the vicinity of Kom Ombo (Saleh, 1997)

No.	Species	Project Site	Western Desert	IUCN Listing
	Agamidae			
1	*Trapelus mutabilis*		√	LC
	Gekkonidae			
2	*Stenodactylus sthenodactylus*	√	√	LC
3	*Tarentola annularis*		√	LC
4	*Tropiocolotes steudneri*	√	√	LC
	Lacertidae			
5	*Acanthodactylus boskianus*		√	LC
6	*Acanthodactylus scutellatus*	√	√	LC
7	*Mesalina guttulate*		√	LC
8	*Mesalina rubropunctata*	√	√	LC
	Scincidae			
9	*Chalcides sepsoides*	√	√	LC
	Colubridae			
10	*Psammophis aegyptius*	√	√	LC
11	*Malpolon moilensis*		√	LC
12	*Spalerosophis diadema*		√	LC
	Viperidae			
13	*Cerastes cerastes*	√	√	LC
	Total number of species	**7**	**13**	

Figure 9-7 Reptiles of the Project Site and Study Area



Photos by M. Saleh

Avifauna

The survey recorded the numbers and distribution of all birds occurring at the Project Site or its immediate vicinity. Some observations were also made in the nearby areas of the Nile Valley and the agricultural area around Faris. The survey covers breeding, wintering and some

migrant bird species using that area. The survey was carried out during the month of January, 2020.

A total of 28 bird species were recorded during this survey. It is likely, however, that more species occur in that area than those recorded during this relatively brief, four days survey, particularly during peak migration season. Throughout the survey period, none of the observed species seem to regularly visit/use the project site for foraging, nesting or other activities.

The table presents shows a list of species observed during field survey, covering both desert and the Nile Valley habitats in the study area. This avifauna is typical of that of the southeastern region of the Western Desert and the upper Egypt Nile Valley.

Table 9-2 Birds recorded at the Study Area in the vicinity of Kom Ombo, their breeding status (Goodman and Meininger, 1989) and IUCN listing (IUCN, 2016). Breeding status: RB = resident breeder; WV= winter visitor; PV = passage visitor)

No.	Species	Desert	Nile Valley	Breeding Status	IUCN Listing
	Pelecaniformes				
1	*Egretta garzetta*		√	RB, WV	LC
2	*Bubulcus ibis*		√	RB	LC
	Acciptriformes				
3	*Elanus caeruleus*		√	RB	LC
	Falconiformes				
4	*Falco tinnunculus*		√	RB, PV	LC
	Columbiformes				
5	*Streptopelia senegalensis*		√	RB	LC
6	*Columba levia*		√	RB	LC
	Strigiformes				
	Bubo bubo	√	√	RB	LC
	Athene noctua		√	RB	LC
	Coraciformes				
7	*Merops orientalis*		√	RB	LC
	Upupiformes				
8	*Upupa epops*		√	RB PV	LC
	Passeriformes				
	Hirundo rustica		√	RB PV WV	LC
9	*Ptyonoprogne obsoleta*		√	RB	LC
	Phylloscopus collybita		√	WV	LC
	Prinia gracilis		√	RB	LC
10	*Galerida cristata*		√	RB	LC
	Ammomanes cinctura	√		RB	LC
11	*Ammomanes deserti*	√		RB	LC
	Alaemon alaudipes	√		RB	LC
	Anthus cervinus	√	√	PV	LC

No.	Species	Desert	Nile Valley	Breeding Status	IUCN Listing
12	*Motacilla alba*	√	√	PV WV	LC
13	*Motacilla flava*	√	√	RB PV WV	LC
14	*Oenanthe deserti*	√		RB PV WV	LC
15	*Oenanthe lugens*	√		RB, WV	LC
	Oenanthe monacha	√		RB	LC
	Oenanthe leucopyga	√		RB	LC
16	*Passer domesticus*		√	RB	LC
17	*Corvus ruficollis*	√		RB	LC
18	*Corvus corone orientalis*		√	RB	LC
	28	**12**	**20**		

Figure 9-8

The figure below shows examples of the avifauna of the area.

Figure 9-8 Examples of birds of the Kom Ombo area

Photos by M. Saleh

In terms of numbers, very few birds were observed in the Project footprint and its immediate vicinity at any one time. None of these birds seems to regularly use the site and their occurrence there seems to be transient. This may be attributed to the limited vegetation cover and hence food resources at that site and its surrounding area. Encountered birds at the site and the study area included both migratory and resident species.

Most of the resident birds of the project site and the surrounding area are true desert species and are typical of the Western Desert. Like most desert animals, the great majority of the species are insectivorous. For most species, insects and reptiles are the most important food items, which also provide the bird with their water requirements.

Several bird species typical of the Nile Valley's mesic habitats have also been observed. Species such as the Palm dove (Streptopalia senegalensis), the house sparrow (Passer domesticus) and the Cattle Egret (Bubulcus ibis) are typical throughout this region. Habitat segregation between birds of the Nile Valley and those of the desert is evident, with most species being restricted to habitats either the Nile Valley or the adjacent desert.

There is no evidence that any major migratory bird flyway passes through the southern region of the Nile Valley in Egypt. Although many species of migratory birds occur in the Aswan area during winter month, there is no evidence that large flocks of the East African/ Red Sea flyway pass through the southern region of the Nile Valley in Egypt. No migratory bird flocks were recorded during the observation period at the study area. One exception was the numerous individuals of the migratory, European Barn Swallow, which were observed around the Faris area throughout the survey time. The largest bird flocks observed in the area were those of the resident Cattle Egret, the largest of which including about 30 birds. No flocks of any size were observed over the desert area. The majority of observed migratory birds were individuals or in small groups of less than 5 individuals.

The area and the Project Site do not seem to intercept any large migratory bird flights. It may also be concluded that the project area is situated in an area limited importance to migratory or resident birds. Furthermore, none of the bird species observed during this survey or those that are likely to occur in the area are listed as threatened locally or internationally (IUCN lists).

Mammals

The table below presents a list of the mammals recorded or observed at the project site and surrounding area. Nine mammalian species are listed. Three rodent species (Gerbillus gerbillus, G. pyramidum and Meriones crassus) have been live trapped at the project site proper during this survey. Abundance of these, usually common rodents, appears to be extremely low, and they are restricted to a vegetated, very small areas on the site. Tracks of the Red Fox (Vulpes Vulpes) and the Rüppell's Fox (Vulpes rueppellii) have been observed throughout the site. All records of observed or trapped animals came from the vegetation patches or the garbage area next to the buildings north of the site.

None of the recorded mammals are listed as threatened internationally or locally.

Table 9-3 Mammals recorded from the Hamrawein – Quseir area and their IUCN status

No.	Species	Project Site	Western Desert	IUCN Listing
	Chiroptera			
1	*Rousettus aegyptiacus*		√	LC
2	*Rhinopoma hardwickei*		√	LC
	Pipistrellus kuhlii		√	LC
	Rodentia			
3	*Gerbillus gerbillus*	√	√	LC
4	*Gerbillus pyramidum*	√	√	LC
5	*Meriones crassus*	√	√	LC
6	*Jaculus jaculus*		√	LC
	Carnivora			
7	Red Fox (*Vulpes vulpes*)	√	√	LC
8	Rüppell's Fox (*Vulpes rueppellii*)	√	√	LC
	Total number of species	**5**	**9**	

Figure 9-9 Examples of mammals of the study area

Photos by M. Saleh

9.4 Receptors

Table 9-4 Ecology - Receptor Sensitivity

RECEPTOR	RECEPTOR SENSITIVITY	JUSTIFICATION
Habitats	**Low**	Site habitats are common for the wider region in Egypt, and are considered to be 'natural', with no specific importance, vulnerability or potential for consideration as a critical habitat.
Flora	**Low**	Flora is very limited and sparse on the site comprising single species common vegetation for this region of Egypt.
Fauna	**Low**	Very little fauna has been observed on the site. All fauna observed and known to occur in the study area of Least Concern status, without other special protection or designation in Egypt.

9.5 Potential Impacts, Mitigation, Management & Residual Impact

9.5.1 Construction Phase

The presence of construction equipment, workers, temporary facilities and environmental externalities resulting from construction processes (i.e. noise, vibration, waste and wastewater) have the potential to impact upon ecology during the construction phase. Due to the need for site clearance and levelling in places, such impacts will include the conversion/loss of habitat and flora species as well as resulting disturbance to fauna.

Loss of Habitat and Flora

Site preparation works will result in complete removal of all vegetation on site. This will be as a result of grading for levelling, foundations, excavations for below ground infrastructures, trenching and backfilling for cables, etc. Therefore loss of the existing low value flora habitat is anticipated within the site of proposed works and areas used for construction laydowns (i.e. material stores and temporary waste storage areas), as well as at any temporary administration buildings. Although a 'natural' habitat, the type of habitat is considered to be common and low value, with flora species observed common in the wider region. The impacts are therefore expected to be relatively minor.

Disturbance to Fauna

A very low number of mammal and reptile species were observed within the site footprint, with only 12 separate sightings of individuals during the baseline survey. All of these species were observed in areas of vegetation or in proximity to temporary construction buildings adjacent to the site.

Such ground dwelling fauna and smaller invertebrates may be directly impacted by earthworks during construction, and will be impacted by removal of flora habitat for refuge. It is possible that such species may invoke a flight response upon the commencement of daily works and given the availability of other similar habitat off-site (also expected to have ample carrying capacity) this may result in reduced impacts.

Avifauna typically was not observed to interact with the site surface and therefore may not be impacts or may be impacted to a lesser extent.

Table 9-5 Terrestrial Ecology Impact Significance, Mitigation & Management Measures and Residual Impacts – Construction

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Habitat Loss	**Minor Negative**	Habitat	Low	**Negligible to Minor**	• There will be no encroachment to land outside of the project footprint, or defined laydown areas, site access road, or designated construction access road. • All vehicles and equipment to be restricted to movements within the project boundaries and designated site access roads. • Any sightings of fauna during construction activities must be reported to the Environmental Manager. • Any sightings of avifauna species on-site during construction activities must be reported to the Environmental Manager; • The Project area boundaries will be temporarily fenced to deter fauna (particularly larger mammals) from entering the active construction site. • To aid re-vegetation, topsoil from the vegetated sand sheets (containing the most nutrient rich soils) should be removed and stored for spreading over any laydown areas once construction has been completed.	**Negligible**
		Flora	Low	**Negligible to Minor**		**Negligible**
		Fauna	Low	**Negligible to Minor**		**Negligible**
Disturbance to Fauna	**Minor Negative**	Fauna	Low	**Negligible to Minor**	• It is strictly prohibited to capture or remove any fauna from their natural habitat. • Where animal burrows are encountered on the project site the contractor will make efforts to ensure that they vacate their burrows prior to excavation works daily. • Where possible works should be phased in a direction to drive fauna off-site and not towards on-going or future construction works. • It is not permitted to kill or eat any fauna on site. Any mortality must be formally reported and recorded on the same day of occurrence (This includes mortality or injury due to collision with construction vehicles). • A 20km/h speed limit will be imposed across the construction site in order to minimise risk of direct mortality of fauna.	**Negligible**

9.5.2 Operational Phase

Exposure of habitats to chemical additives and hazardous materials

Inadequate storage and handling of hazardous materials/wastes, chemicals and fuels could directly affect habitats (e.g. landscaped areas). The use of any herbicides, pesticides and fertilisers may potentially impact on faunal species and local vegetation, thereby increasing the secondary poisoning of non-targeted species.

Pest Attraction

Pests and vermin such as rodents, cockroaches and flies may be attracted to site by the accumulation of wastes (particularly domestic food wastes) if these are not stored and disposed of appropriately. Pests have the potential to spread disease to fauna and humans, as well as driving away faunal species.

Bird Mortality

Birds in proximity to the site are not expected to be impacted by the project directly, but may indirectly be attracted to the site under the influence of 'lake effect', a potential phenomenon whereby birds mistake the reflective surfaces of solar PV panels for the surface of water. Although lacking firm research, there is suggestion amongst the scientific community and avian protection bodies that 'lake effect' has the potential to injure birds or lead to their mortality where birds attempt to land on the PV panels.

Table 9-6 Terrestrial Ecology Impact Significance, Mitigation & Management Measures and Residual Impacts – Operation

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Exposure of Habitats to chemical additives and hazardous materials	**Minor Negative**	Flora	Low	**Negligible to Minor**	• Landscaping on site should incorporate indigenous plant species to minimise irrigation requirements and the need for fertilisers/pesticides. Intentional replanting of vegetation would enhance the biodiversity of the site as well as improve the visual aesthetics of the site. • Prevent introduction of any alien or invasive flora species that might spread beyond the boundary of the Project site. • Hazardous materials and chemicals will be stored in designated areas in accordance with the requirements of EEAA and good practices guidelines so as to prevent any spillages on the site.	**Negligible**
	Minor Negative	Fauna	Low	**Negligible to Minor**		**Negligible**
Pest Attraction	**Negligible Negative**	Fauna	Low	**Negligible to Minor**	• Implement an integrated pest management scheme to minimise the use of pesticides where practical. A plan to manage pests should be prepared to outline specific mitigation and management measures.	**Negligible**
Bird Mortality	**Negligible Negative**	Fauna	Low	**Negligible to Minor**	• Development of potential bird habitats (i.e. artificial water bodies, forest plantations, etc.) should be avoided within and in the immediate surrounding areas of the solar park. This will avoid attraction of significant bird population within the Project area.	**Negligible**

9.6 Monitoring

The EPC Contractor and O&M Company will undertake terrestrial ecological monitoring during the construction and operational phases of the project respectively. The minimum expected requirements for the monitoring are outlined in the table below. The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan' Plan' as part of the construction phase ESMS.

Table 9-7 Terrestrial Ecology – Monitoring Requirements

MONITORING	PARAMETERS	FREQUENCY & DURATION	MONITORING LOCATION
Construction			
Fauna	Fauna species observed on the site	Daily visual observations of live fauna and burrow locations by workers at the commencement of working activities, and general observations throughout the day – to inform evacuation of specific burrows. To include translocation of live fauna off-site.	In all working area requiring land grading or earthworks.
Operation			
Fauna	Fauna species	Visual observations for sightings of fauna within the Project site, including translocation of live fauna off-site.	The entire Project area.
Avifauna	Birds	Daily visual observations for bird mortality. Record keeping in regard to deceased bird species found.	The areas around the solar panels.

10 CULTURAL HERITAGE

10.1 Introduction

This chapter assesses the potential impacts and effects on cultural heritage that may occur as a result of the projects construction and operational activities and identifies the measures that will be undertaken and implemented in order to mitigate these impacts.

10.2 Standards and Regulatory Requirements

10.2.1 National Requirement

Egypt law on the Protection of Antiquities, Law No. 117 of 1983 (amended by Law No. 3 of 2010) establishes the Ministry of State for Antiquities, previously known as the Supreme Council of Antiquities as the sole mandated authority permitted to undertake and approve archaeological assessments within Egypt.

The principal mission of the Ministry of State for Antiquities, is to protect and promote the cultural heritage of Egypt, both independently and in cooperation with national and international organizations. To achieve its goals, it formulates and implements all policies concerned with antiquities; issues guidelines and permits for the excavation, restoration, conservation, documentation, and study of sites and monuments; and manages a country-wide system of antiquities museums.

Law No. 117 of 1983 (amended by Law No. 3 of 2010) on the Protecting of Antiquities provides the following:

- Antiquities are defined as all movable and immovable objects, which are produced by the arts, sciences, literatures, customs, religions, etc. from prehistoric times to the reign of Ismail. Also included are any movable or immovable objects produced by foreign civilizations that were at one time related to Egypt (i.e. Greek, Ptolemaic, Roman, Libyan, Persian, etc.) that are found within Egypt's borders. Any movable or immovable object declared to be an antiquity.
- All antiquities, either known or concealed, ultimately belong to the State, and are required to be registered on an official inventory. Modification, displacement or demolition of classified antiquities is prohibited. The State maintains the right to expropriate any antiquity, or land containing antiquities. Discovery of antiquities should be reported immediately to the nearest administrative official; the State may acquire any such antiquity for national collections, and the displaying of such antiquity.
- A permit is legally required for all field research, the conditions of which are set at the time of granting of the permit. All foreign nationals are required to submit a security declaration form to the Ministry of Culture Security Office, via the SCA.

- Exportation of cultural property (including environmental and biological samples) is strictly prohibited without a permit, which must be obtained 30 days prior to the intended date of export. Movement of antiquities within the country must be approved 15 days prior to their transportation.
- Dealers in antiquities must be licensed, and must maintain a daily register of transactions. Antiquities offered for sale must be authorised by the museums in advance.
- The Supreme Council of Antiquities under the auspice of the Ministry of Culture, are responsible for the restoration and preservation of Egypt's cultural heritage.

It is expected that the Project will need to obtain a permit from the Ministry of Antiquities for the proposed land for the Project's development prior to the commencement of construction works.

10.2.2 Lender Requirements

EBRD Performance Requirements

EBRD Performance Requirement 8 recognises the importance of cultural heritage, both tangible and intangible for present and future generations. The aim is to protect cultural heritage and to guide clients in avoiding or mitigating adverse impacts on cultural heritage in the course of their business operations. The clients are expected to be precautionary in their approach to the management and sustainable use of cultural heritage.

African Development Bank (AfDB)

The AfDB Operational Safeguard 1 for Environmental and Social Assessment includes requirements for the assessment of development impacts upon cultural heritage (tangible and intangible).

Specifically, the borrower is responsible for ensuring that project sites and designs avoid significant damage to cultural heritage, including both tangible and intangible cultural heritage. Such mitigation and/or management processes ned to be robustly assessed via the impact assessment.

Equator Principles

In accordance with the Equator Principles, requirements for projects located in non-OECD countries and OECD countries not classified as high income (as defined by the World Bank Development Indicators Database), the assessment will refer to applicable IFC Performance Standards on Social and Environmental Sustainability, specifically with due consideration of Performance Standard 8 – Cultural Heritage.

IFC Performance Standards

IFC Performance Standard 8 on Cultural Heritage recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity. Its aim is to protect the adverse impacts of project activities and support its preservation and to promote equitable sharing of benefits from the use of cultural heritage.

Cultural heritage in this standard refers to:

- Tangible forms of cultural heritage, such as tangible moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values;
- Unique natural features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls; and
- Certain instances of intangible forms of culture that are proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.

10.3 Baseline

There are numerous sites of archaeological and cultural importance in the Arab Republic of Egypt. The preservation and protection of such resources is vital in maintaining the national culture and heritage.

10.3.1 Archaeology and Cultural Heritage in Egypt

According to the National Environmental Action Plan of Egypt 2002/2017, Egypt's cultural heritage is a major economic asset as well as providing many of the components of national identity and sense of continuity. The major touristic attractions are the Pyramids, the Sphinx, Thebes and the Nubian monuments of the Pharaonic era and Coptic and Islamic monuments. Egypt is the home to five (5) sites that are on the UNESCO list of World Cultural Heritage.

A majority of Egypt's cultural heritage sites are being damaged by one or several of the following problems: sprawl of human settlements; air pollution; rising water table; industrial and vehicular vibrations; garbage pollution. The Sphinx, for example, which has stood for millennia, has been deteriorating at a vastly increased rate during the last 50 or more years. Increased levels of pollution, trigger chemical and biological reactions that weaken the limestone make it more susceptible to wind erosion.

Some of the Archaeological sites in Egypt as found in the Ministry of Antiquities website and World Heritage Sites as found in UNESCO website include but not limited to:

Archaeological Sites

- The Missing Obelisk – Aswan Governorate
- The Palace City – New Valley Governorate
- Karnak Temple – Luxor Governorate
- Luxor Temple – Luxor Governorate
- Valley of the Kings - New Valley Governorate
- Valley of the Queens - New Valley Governorate
- Hatshepsut Temple - New Valley Governorate

World Heritage Sites

- Abu Mina – This site occupies approximately 182.7 ha of land and is found in the Alexandria Governorate. It was discovered in 1905 and became a world heritage site in 1979. This cultural heritage is threatened.
- The Whale Valley – Found in the Faiyum Governorate covers an area of 20,015ha. it was chosen by UNESCO as a World Heritage Site for whale skeleton. This site is not threatened.
- Ancient Thebes with Necrropolis – Found in the Qina Governorate. This site occupies approximately 7,390ha
- Memphis and its Necropolis (the pyramid fields from Giza to Dahsur) – This site was considered one of the Seven Wonders of the World in ancient times. This site occupy about 16,358ha and became a World heritage site in 1979.
- Nubian Monuments from Abu Simbel to Philae –These archaeological area contains magnificent monuments as the Temples of Ramses II at Abu Simbel and the Sanctuary of Isis at Philae. It occupies about 374.5ha.

Aswan Governorate

Aswan Governorate is famous for its cultural and touristic sites. Of its famous historical sites are Elephantine temple and the Fatimide Cemetery. Archeologists recently found 35 mummies in Aswan which date back to the Greco-Roman period[4].

Kom Ombo City was considered the first capital and metropolis of Upper Egypt during the Greco-Roman period[5]. One of its main attractions is the ancient Temple of Kom Ombo, which

[4] https://www.theguardian.com/world/2019/apr/24/mummified-remains-of-35-ancient-egyptians-found-in-aswan

[5] https://www.oeaw.ac.at/en/oeai/research/settlement-archaeology-and-urbanism/kom-ombo-city-and-hinterland/

is located in Kom Ombo Administrative Center. The ancient Egyptian name of Kom Ombo is "Nibit", which means the new one[6]. Kom Ombo, on the other hand, means "The Hill of Gold"; where the word "Kom" in Arabic means hill and "Ombo" means gold in hieroglyphics.

Kom Ombo Temple is located on the east side of the Nile, 45 km away from the city of Aswan. The Temple lies around 27 km away from Faris village. The Temple was built in the Ptolemaic period, which lasted from 108 to 47 BC, with some additions built later in the Roman period. The temple is considered unique due to its two identical sectors, the southern half dedicated to the worship of Sobek (symbol of fertility) and the northern part dedicated to the worship of Horus (the protector of Egypt)[7]. In addition, archaeological sites were found in the basin of Kom Ombo that date back to the Paleolithic era.

10.3.2 Project Site

There are no known or recorded sites of cultural importance (including tangible archaeological sites) in the Project area or the immediate vicinity or surroundings of the Project, including the access road and electrical connection points.

This has been corroborated to date in the scoping consultation sessions and other focus groups conducted as part of the consultation activities. There has been no concern raised or other knowledge imparted about cultural features on these lands.

10.4 Sensitive Receptors

Sensitive receptors concerning cultural heritage are determined as those in close proximity to the Project site and which have the potential to be impacted by the construction and operation of the Project.

As the proposed project site is not known to have recorded archaeology or other tangible or intangible features of cultural importance, the only delineated receptor within the Project's area of influence relates to potential unknown underground buried artefacts.

Table 10-1 Cultural Heritage – Sensitive Receptors

RECEPTOR	SENSITIVITY	JUSTIFICATION
Unknown Buried Archaeology	**Medium**	Such unknown buried artefacts may be of importance on a local or regional scale.

[6] Ibid
[7] https://www.atlasobscura.com/places/temple-of-kom-ombo

10.5 Potential Impacts, Mitigation, Management & Residual Impact

10.5.1 Construction Phase

Excavation and earthwork activities can result in damage and destruction of undiscovered archaeological artefacts. Although archaeological sites and/or tangible/intangible features of cultural importance have not been identified within the Project boundaries this doesn't rule out the potential for encountering buried artefacts. As such, there is no evidence of recorded features, the presence of archaeological features within the project footprint is expected to be low.

Table 10-2 Cultural Heritage Impact Significance, Mitigation & Management Measures and Residual Impacts - Construction

Impacts	Magnitude of Impacts	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Accidental damage unknown archaeological resources buried within the Project site.	**Minor Negative**	Unknown Buried archaeological artefacts or remains	Medium	**Minor**	• An archaeological 'Chance Find Procedure' will be developed prior to construction and the start of site earthworks, as part of / or alongside the CESMP. This will include protocols and procedures to stop work and methods to preserve potential finds, as well as reporting requirements and co-ordination with the Ministry of State for Antiquities. • Where artefacts or archaeological remains are encountered, the site will be clearly signed/delineated with high visibility flagging to impede access and prevent any damage or loss of the artefacts which have just been found. • All direction concerning the management of potential archaeological finds must only be taken from the Ministry of State for Antiquities; or the respective delegated governmental authority locally in Aswan. • Contractor crew to be informed during training about the chance finds procedure and key processes to follow concerning any suspected archaeological finds to avoid disturbance. • Removal of any archaeological artefacts from the site is strictly prohibited.	**Negligible to Minor**

10.5.2 Operational Phase

Due to the lack of cultural features or archaeological sites, the operational phase activities of the Project are not expected to result in further impacts to cultural heritage.

10.6 Monitoring

The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan'.

Table 10-3 Cultural Heritage - Monitoring Requirements

MONITORING	PARAMETER	FREQUENCY & DURATIONS	MONITORING LOCATION
Construction			
Archaeological Resources & Artefacts	Undiscovered archaeological remains within the Project site	Daily continued visual observations by site staff involved in excavations.	The Project area requiring excavations, earthworks or grading.

11 LANDSCAPE AND VISUAL AMENITY

11.1 Introduction

This chapter assesses the impacts from the Project on the landscape character and visual amenity of the local area. This chapter also identifies the specific management measures in regard to landscape and visual amenity.

11.2 Standards and Regulatory Requirements

Specific Egyptian legislation regarding landscape and visual conditions does not exist however impact assessment has been undertaken with reference to the guidelines set out by the UK Landscape Institute 'Guidelines for Landscape and Visual Impact Assessment 3rd Edition' (2013). As such, the 'Landscape and Visual Assessment' assessment presented herein will distinguish between:

- Effects on landscape as a resource in its own right; and
- Effects on specific views and general visual amenity experienced by people.

11.3 Baseline

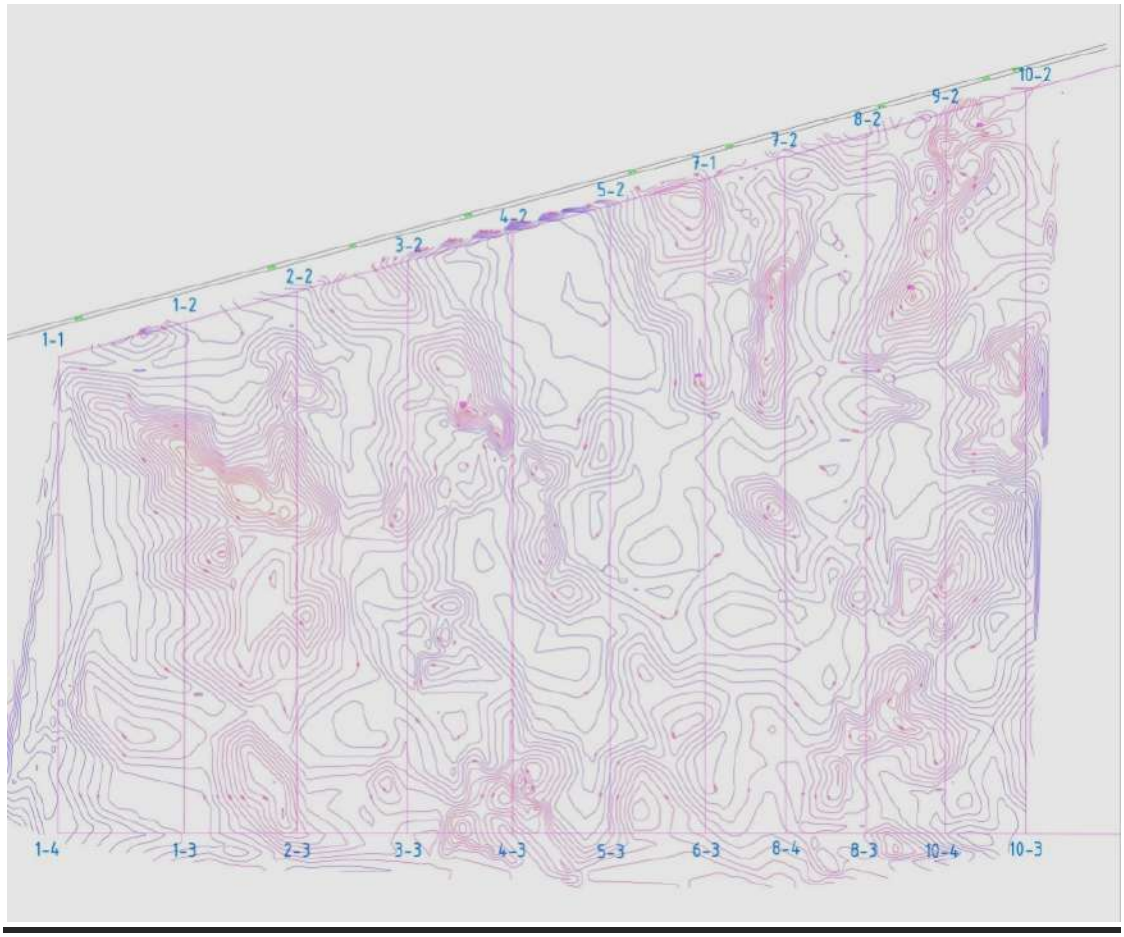
Landscape

The Kom Ombo PV Power Project will be developed on land that is predominantly undeveloped and open located west of the Nile River, north west of the town of Kom Ombo city in the Aswan Governorate of Egypt.

Figure below presents the topography map of the Project site. The topography of the Project site is mainly flat with small hills ranging in elevation from 2 m to 4 m above the main elevation of the area which is ranges from 146.5m to 148m above sea level (Hamza Associates, 2016).

The Project site is characteristic of the wider area and is relatively flat with large sandy expanses and little vegetation. There are no specific landscape designations in this area.

Figure 11-1 Topography Map of Project Area (Hamza Associates, 2016)

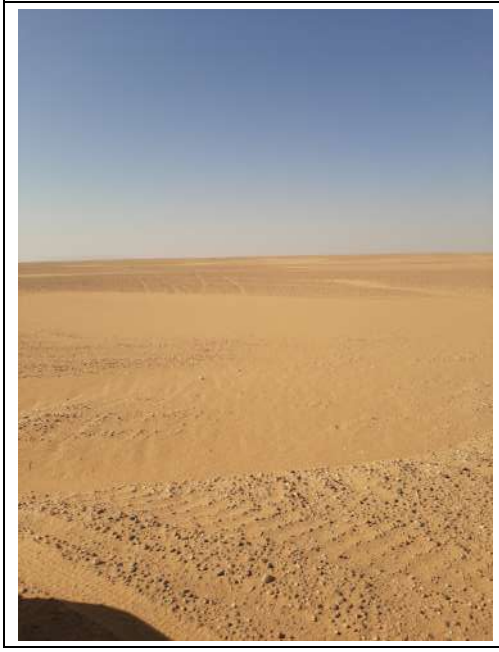


The anthropogenic contributions to the landscape of the Project area include the following:

- Local Contractors Caravans north of the project site (approximately 150 m and across the road);
- Faris Contractors union north east corner from Project site;
- TSK PV Plant located east of the Project site;
- The existing 220kV Overhead Transmission Line (OHTL) approximately 100m to the east of the project site; and
- The 2-way single carriageway road that runs perpendicular to the Al Ramadi Kebii – Al Raqaba road and the Luxor-Aswan road and connects the village of Faris to the Luxor-Aswan road.

Photographs of the project landscape and topography is provided below.

Plate 11-1 Project Landscape and Topography – Compilation of Photographs

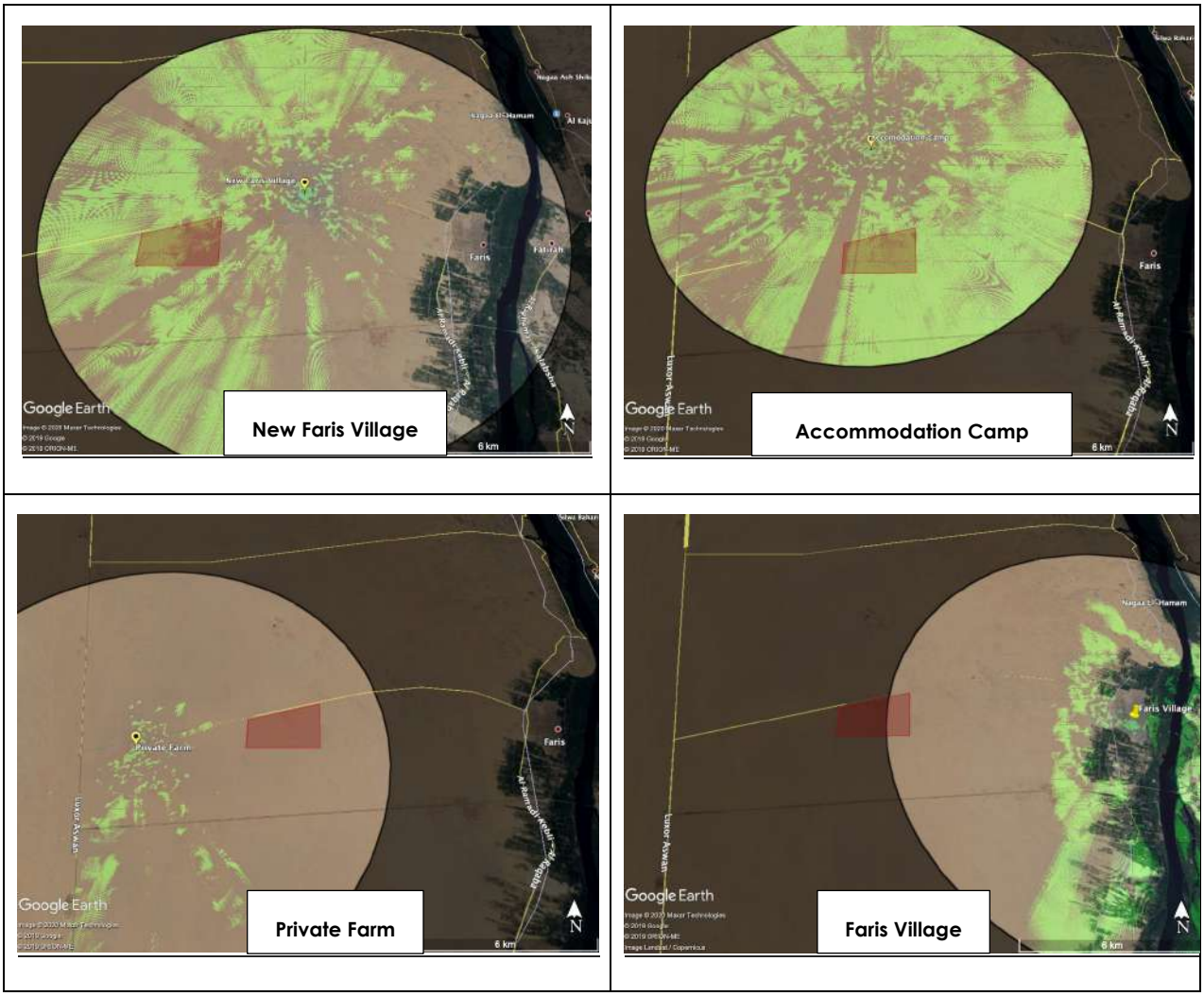
SITE PHOTOGRAPHS	
A- Project site and view across the western region of the site	
	
B- A- Project site and view across the eastern region of the site	
	

Visual

There are no permanent dwellers within 1 km from the Project site. Permanent dwellings over 1km from the Project site boundary include the New Faris Village located 3.2km north east of the Project site, the accommodation camp located approximately 4.7km north of the Project site, the private farm approximately 5 km west of Project site and Faris village approximately 8.8km east of the Project site. In order to establish the areas in which the Kom Ombo PV Power Project may be visible from, the following viewsheds have been generated for the above

permanent receptors. The green area presents the geographical area that is visible from that location/ receptor. As can be seen from the images below, the Kom Ombo PV Power Plant will be most likely visible from the New Faris Village and accommodation camp.

Figure 11-2 Viewshed Images



11.4 Sensitive Receptors

With regards to visual receptors, besides the accommodation camp and the New Faris Village, review of satellite imagery and site visits to the Project site did not identify any other visual receptor that may potentially be impacted as a result of the Project's construction and operational activities.

RECEPTOR	SENSITIVITY	JUSTIFICATION
Landscape Character	**Low**	The landscape in the area is not considered significant as there are no unusual, or significant protected areas and site exhibits a similar landscape context across the wider area (desert landscape).

RECEPTOR	SENSITIVITY	JUSTIFICATION
Accommodation Camp (Visual Amenity)	**Low**	Residents of the camp will have a direct visibility of the Project; however, most likely workers will be working during the day and will only use the camp during the evenings and night. Therefore, the visual amenity of residents at this camp will not be significantly impacted as a result of the Project.
New Faris Village Amenity)	**Medium**	Currently the houses at the village are not occupied and during the site visit conducted in December 2019, the entire village seemed empty. Nevertheless, the PV plant is partially visible from the village and will only be relatively vulnerable to changes in landscape character.

11.5 Potential Impacts, Mitigation, Management & Residual Impact

11.5.1 Construction Phase

Change in Landscape Character

The construction of a new development, particularly those on a large scale have the potential to result in changes to the landscape character of a locality through land use and topographical changes or other factors. In situations where the visual horizon is disturbed by a development, such impacts may include the anthropogenic intrusion of the landscape by buildings/structures where no intrusion previously existed; or the change in the landscape character of an area, which could arise from new/out of place development or from changes in the land use.

One of the first stages of construction activities will result in the levelling, grading and preparation of the site prior to the commencement of construction. However, given the existing flat nature of the site, grading and levelling activities are not expected to be extensive. The proliferation of other activities such as the subsequent construction of small new buildings and installation of PV Panels which will take place steadily over the construction period and across the site will eventually transform the landscape resulting in major land use changes.

Reduction in Visual Quality

The movement of heavy construction vehicles such as trailers, cement trucks, graders, excavators, loaders, water trucks, waste removal truck, etc. to and from the project site and earthworks on sandy surfaces can potentially result in dust generation and a resulting temporary haze causing disturbance to the current visual envelope of receptors, by changing their visual amenity and/or blocking their views.

Impacts to the visual envelope of surrounding receptors will also occur at night where the addition of lighting during construction will illuminate the proposed project area. The use of

lighting across the site will result in a night time light haze likely to be visible for several kilometres from the project area. Any impacts from lighting are anticipated to be minimised by the implementation of a CESMP on-site.

Table 11-1 Landscape and Visual Amenity Impact Significance, Mitigation & Management Measures and Residual Impacts – Construction

Potential Impact	Magnitude of Impacts	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Changes in Landscape Character	**Minor Negative**	Landscape character of the entire Project site	Low	**Negligible to Minor**	• Land clearance to be limited within the boundaries of the Project site. • Construction works to be limited within the boundaries of the Project site. • Project footprint to be limited within the boundaries of the Project site as per Project proposals. • Lighting provision shall not be excessive or unnecessary and not result in glare effect. • Light fittings shall be directional as deemed appropriate for their use and intended areas of illumination. • Lighting column and lighting head design should be chosen to limit back spill and any unwanted light spill to other site areas or, those areas off the site.	**Negligible to Minor**
Disturbance to Visual Envelope of Receptors	**Minor Negative**	Accommodation Camp (Visual Amenity)	Low	**Negligible to Minor**		**Negligible to Minor**
		New Faris Village	Medium	**Minor**		**Negligible to Minor**

11.5.2 Operational Phase

Landscape Character

The development of the Project will include the installation of thousands of PV panels, the construction of substation, administrative facilities, etc. which will distort the existing undeveloped landscape character. A key change will result from the loss of the view of the characteristic brown sands and gravel, as these will be replaced with a view of dark coloured flat PV Panels occupying an expansive area. The geographical extent of the area that will suffer the change of landscape character or be affected will be limited to the Project footprint) and will be within the boundary of the Project site.

Due to the low-lying design of the PV Plant, views across the wider landscape are unlikely to be significantly impacted as illustrated in the images above (Figure 11-2). Given the distance of permanent receptors from the project site, this visual change from an open, unused landscape to low level infrastructure associated with the project is unlikely to have any significant visual impact.

Visual Amenity

Following the impacts of construction and establishment of project features, the operational phase will not result in changes to the visual envelope of receptors overlooking the Project site. Although lighting impacts will occur, it is envisaged that only minimal lighting will be required at night-time for security purposes and this will be similar to the construction phase. As such significance has not been re-assessed. The mitigation and management measures with regards to light pollution will be the same as construction phase. This will include the deployment of lighting for safety and security that seeks to avoid light spill, sky glow and glare and will utilise efficient low energy systems where appropriate.

11.6 Monitoring

Not proposed for this impact, although any third-party complaints on this topic will be gathered via the Projects construction and operational grievance mechanisms.

Table 11-2 Landscape and Visual Amenity Impact Significance, Mitigation & Management Measures and Residual Impacts – Operation

Potential Impact	Magnitude of Impacts	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Changes in Landscape Character	**Minor Negative**	Landscape character of the entire Project site	Low	**Negligible to Minor**	• Project footprint to be limited within the boundaries of the Project site as per Project proposals • Lighting provision shall not be excessive or unnecessary and not result in glare effect. • Light fittings shall be directional as deemed appropriate for their use and intended areas of illumination. • Lighting column and lighting head design should be chosen to limit back spill and any unwanted light spill to other site areas or, those areas off the site.	**Negligible to Minor**
Disturbance to Visual Envelope of Receptors	**Minor Negative**	Accommodation Camp (Visual Amenity)	Low	**Negligible to Minor**		**Negligible to Minor**
		New Faris Village	Medium	**Minor**		**Negligible to Minor**

12 COMMUNITY HEALTH, SAFETY AND SECURITY

12.1 Introduction

Project related activities might result in the increase of risks associated with those who live near the Project site or may visit areas in and around active Project sites. This may include public health and safety related issues, as well as issues that impact certain groups of people. This chapter outlines and assesses the impacts relating to those who may be subject to project related impacts.

It is noted that impacts relating to public health (e.g. which for example may occur from air quality, noise, waste management etc.) have been assessed in other specific chapters of this report.

12.2 Standards and Regulatory Requirements

EBRD Performance Requirements

EBRD Performance Requirement 4 establishes the importance of avoiding or mitigating adverse health and safety impacts and issues associated with project activities on workers, project affected communities and consumers. The objectives of EBRD PR4 are:

- To protect and promote the safety & health of workers by ensuring safe and healthy working conditions and implementing a health and safety management system, appropriate to the relevant issues and risks associated with the Project.
- To anticipate, assess and prevent or minimse adverse impacts on the health and safety of project affected communities and consumers during the project lifecycle from both routine and non-routine circumstances.

African Development Bank (AfDB)

Identification and assessment of Community related issues are required under AfDB Operational Safeguard 1 and need to be included to the Environmental & social Assessment process.

Specifically, the borrower must give particular attention to assessing the risks and potentially adverse impacts of the project on local communities, including direct and indirect impacts on their health or safety and indirect impacts on their socioeconomic conditions and livelihoods. This includes identifying vulnerable people/groups and issues relating to gender. The borrower or client establishes preventive and management measures consistent with good international practice as described in the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

IFC Performance Standards

IFC Performance Standard 4 establishes requirements for the safeguard of the local community from potential risks associated with the project including impacts associated with introduction of communicable disease, site access and operation, material use etc. The objectives of IFC PS4 are:

- To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.
- To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

12.3 Baseline

12.3.1 Land Users

The identification of nearby land uses, communities, public and commercial activities has been delineated in Chapter 2 of this ESIA. This has identified that the immediate Project site and local area has few active land uses or communities that use the land and/or may come into contact with the Project (or the land it is on) in the course of their regular day-to-day activities.

12.3.2 Local Communities and Groups

The nearest active community to the Project is the Faris Village which is located 8.8km to the east of the Project site. An abandoned and uninhabited residential development is closer (approximately 3.2 km north-east of the site), but there are currently no populations or communities using this area.

The Faris Contractors Union have established a small building situated approximately 100m from the north eastern corner of the Project site. This building and associated mobile caravans serve as an office from which employment at the other nearby solar PV projects is being sought. It is known that several people from this group are involved in waste management at the on-going PV construction projects.

12.3.3 Vulnerable Groups

During the site visits and consultations there has been no specific identification of potential vulnerable groups, such as those including: 'landless people; people without legal title to assets; ethnic, religious or linguistic minorities; some categories of children (orphans, homeless); marginalised social groups and people who are sometimes referred to as indigenous peoples'

(as per examples for vulnerable groups stated in AfDB Integrated Policy Safeguards Statement).

12.3.4 Gender

In the context of gender, it has only been males that have been observed close to the site at the Faris Contractors Union building. The E&S assessment team has specifically interacted with group of females during consultation in Faris Village, but the general day-to-day context is of males being more present in the Project area and the males who are seeking employment in construction related jobs, via the Faris Contractors Union.

12.4 Potential Impacts, Mitigation, Management & Residual Impact

12.4.1 Construction Phase

Influx, Community Health & Crime

The construction phase of the Project will require a dedicated workforce of permanent staff, contractors, as well as the use of specialist sub-contractors and key supply chains. This will therefore lead to an increase in the population on-site during construction, as is the case on such sites (and as has been witnessed locally at other PV projects in Kom Ombo).

Accommodation

It is expected that a large proportion of the construction workforce will relate to sub-contractor staff rather than Project Company or EPC Contractor staff. At present there has been no confirmation on the location and number of required contractor camps for workers. Further, as the sub-contractor contracts are not yet confirmed, it is not known whether such staff will be for local communities and live in their normal residences (such as Faris Village), or will require Project accommodation.

At present the Project's temporary facilities do not include a contractor camp, and as such it is expected that the Project's workforce will be accommodated in facilities off-site. For example, there is a known contractor camp approximately 5km north of the Project where contactors can rent accommodation facilities. It is also likely that local guesthouses and or other temporary camps may be used or even established to house workers.

Influx of workers can lead to issues when mixing with established communities and can occasional lead to other cultural issues. The EPC Contractor for the Project will be an Indian firm, whose staff may have alternative ideals, behaviours and cultural practices than the local populations. Such interactions could lead to potential conflicts, or may result in crimes.

Much of the general interaction (besides interaction on site) will depend on the location of accommodation facilities, which are yet to be confirmed.

Disease and Illness

The interaction of workers from different areas (and parts of the world), as well as the close-knit mixing of workers on-sites and in labour accommodation may well result in the transfer of certain communicable disease and/or illness. This may also impact upon communities where interactions take place.

Community Safety

All construction projects have potential risks relating to public safety that could arise, particularly in regard to the use of high-powered equipment, heavy construction machinery, excavations, transportation amongst others, including fire and pollution releases (e.g. from hazardous materials & wastes at the site/being transported and untreated sanitary wastewater).

Public risks during construction have the potential to result in isolated incidents, which could be of a devastating magnitude to a person or group of people in the wrong place at the wrong time. For the purpose of the PV Project, such risks (if realised) are expected to be limited to the construction working areas, but may also extend to the access roads used by project vehicles. As such, there are also potential risks related to road safety.

With particular regards to the Project, there are not expected to be specific works that could result in widespread pollution incidents, due to the separation of the Project site from the limited use of hazardous material or chemical storage on-site. Such risks will be suitably managed in the construction phase through the implementation of a robust Security Plan (based on a security risk assessment) and an Emergency Preparedness and Response Plan. Traffic related risks will need to be managed via a robust Traffic Management Plan.

Public/ Community Security

The construction phase of the Project will require site-based security at the gates and on patrol around the site in order to prevent the public from trespassing to the construction site. This is so as to minimize the potential for construction site incidents to occur.

Following suitable security risk assessment by the EPC Contractor, the security arrangements should be guided by UN Code of Conducts for law enforcement officials, the IFC's Good Practice Handbook on the Use of Security Forces: Assessing and Managing Risks and Impacts IFC's and the UN Basic Principles on the use of Force and Firearms by law enforcement officials (if staff are armed).

In addition to this, security personnel will receive internal training in regard to grievances, reporting such grievances and conduct for dialogue with any members of the local community. The workers on the project site will additionally receive cultural awareness training with regard to local customs as such guidance can provide a ready resource on the do's and don'ts of culture-centred behaviour.

12.4.2 Operational Phase

Public/Community Safety

The Project will carry various risks that could result in impacts to public safety where such impacts are transferred or received outside of the project site. Such impacts could potentially relate to fire, VOC fumes, explosions, spills of back up fuels, and security concerns of trespassers.

Although expected to be limited to the site area (as a PV project), the extent of such impacts could range to the Project boundaries or immediately external to the fence line. Where direct impacts migrated outside of the projects boundaries and require the involvement of outside agencies to help manage and abate such impacts (e.g. Civil Defence, Police and Army). Indirect impacts of instances such a fire or fumes are not expected to reach the villages of Faris, but could endanger those at the Faris Contractors Union, if people are present.

Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and via appropriate training of staff.

Public Security

The project constitutes a facility of high importance due to the generation of electricity. The project will also include site-based security at the project main entrance and on patrol around the site.

As is consistent with the construction phase, the O&M Contractor will undertake a security risk assessment to determine the appropriate level of security required at the facility. Security arrangements should be guided by UN Code of conducts for law enforcement officials and UN basic principles on the use of Force and Firearms by law enforcement officials (if staff are armed).

In addition to this, security personnel will receive internal training in regard to grievances, reporting such grievances and dialogue with any members of the local community.

12.5 Mitigation and Management Measures

Table 12-1 Community Health & Safety Mitigation & Management Measures - Construction

Potential Impact	Mitigation and Management Measures
Influx	• Worker accommodation areas shall be managed in accordance with the EBRD and IFC Workers' Accommodation: Processes and Standards. The provision of good quality living accommodation, services and amenities will likely reduce the need for mixing with local communities. • Project induction training will include a section on code of conduct when engaging with local community members. This will include an overview of culturally appropriate measures and etiquette to bear in mind.
Public/Community Health	• The Health and Safety teams on site will provide advice during training/inductions on exposure to disease. • During construction, staff will have access to medical professionals and suitable medical facilities, which will aim to prevent the spread of diseases internally and externally. Site personnel will only be cleared for work after with a medical fitness certificate from an authorized medical center. • Any reportable disease will be diagnosed by the authorized occupation health center doctor. Diagnosis includes identifying any new symptoms, or any significant worsening of existing symptoms. • Any external and internal spreading diseases will be diagnosed and taken the precautions as per the instructions from the national/ local medical authority. • The potential for exposure to water-borne, water-based, vector-borne diseases and communicable diseases as a result from project activities will be avoided or minimised.
Public/Community Safety	• Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and training. • The plan will include the appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be required. • A Traffic Management Plan will be prepared to ensure vehicle related risks can be reduced and managed (amongst other items). • Project induction training will include a section on code of conduct when engaging with local community members. This will include an overview of culturally appropriate measures and etiquette to bear in mind. • All high-risk areas (such as hazardous material and hazardous waste storage areas) will be secured with internal fencing and will be monitored throughout the day by designated responsible Project parties. • Appropriate mechanisms for emergency control (e.g. firefighting equipment) will be placed at suitable positions around the site.
Public/Community Security	• The project will employ its own security staff who will provide 24/7 security control across the Project site and dedicated security staff at gatehouses. • The project will be fenced during enabling works stage. • All vehicles entering the site will require pre-approved clearance and will need to be registered. Project security will record all instances of incoming vehicles. • CCTV will be installed at key locations around the site and at gatehouses.

Potential Impact	Mitigation and Management Measures
	• Appropriate lighting will be provided at gatehouses for security personnel to prevent unauthorised access. • Project personnel will only be provided access to the construction site with valid ID cards and permits to work in line with HSE requirements.
Grievance Mechanism	• The project will implement an appropriate system to allow external parties to raise a grievance in regard to the project. • The Grievance Mechanism will be clearly defined, transparent and accessible to identified stakeholders and in line with the Project's SEP.

Table 12-2 Health & Safety Mitigation & Management Measures - Operation

Potential Impact	Mitigation and Management Measures
Public/Community Safety	• Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and training. • The plan will include the appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be required. • The employees during the operational phase shall undergo a Code of Conduct training to ensure smooth coordination with the neighboring community. • Appropriate mechanisms for emergency control (e.g. firefighting equipment) will be placed at suitable positions around the site. • Grievance Redressal Mechanism shall be made accessible to the community to ensure that community members wish to raise grievances to the Project leadership.
Public/Community Security	• The project will employ its own security staff who will provide 24/7 security control across the Project site and dedicated security staff at gatehouses. • All vehicles entering the site will require pre-approved clearance and will need to be registered. Project security will record all instances of incoming vehicles. • CCTV will be installed at key locations around the site and at gatehouses. • Appropriate lighting will be provided at gatehouses for security personnel to prevent unauthorised access. • Project personnel will only be provided access to the construction site with valid ID cards and permits to work in line with HSE requirements.

12.6 Monitoring

Monitoring of Community Health and Safety will be undertaken as required via the management measures outlined above. For instance, monitoring of the security plan will form part of the wider Environmental and Social Management System internal audits to be undertaken monthly during construction and quarterly during operations.

Table 12-3 Key monitoring indicators (Construction & Operations)

MONITORING	PARAMETER	FREQUENCY & DURATIONS	MONITORING LOCATIONS
Construction & Operations			
Illness	Records of sickness/illness and diseases within the workforce	On-going	For all Project workers (direct staff and sub-contractor staff)
Near Misses (involving external parties)	Any classified near miss	On-going	n/a
Emergency Situations and Incidents	Any classified emergency situation or incident	On-going	n/a
Third-Party Grievances	Grievances received	On-going	As defined in the Stakeholder Engagement Plan (SEP)

13 SOCIO-ECONOMICS

13.1 Introduction

This chapter herein presents socio-economic information regarding the local area and region to contextualise population & community structures, dynamics, economics, availability of services, access to utilities etc. An assessment of impacts has been undertaken based on the expected project activities, with developed mitigation & management measures and proposed monitoring.

13.2 Standards and Regulatory Requirements

13.2.1 National Regulations

Guidelines of Principles and Procedures for Environmental Impact Assessment 2nd edition of January 2009 indicate the measures to collect baseline data and assess social economic impacts. According to section 6.4.2.5, baseline description data to be collected include:

- **Social environment**: This data include the general economic features including employment, available infrastructure, etc. and general land use in the area while illustrating sensitive areas as well as social characteristics including population characteristics, available education levels, etc. as well as services and traffic, according to the case.
- According to section 6.4.2.6, a detailed analysis should be conducted in cases where livelihood, involuntary re-settlements and property expropriation is involved.

13.2.2 Lender Requirements

EBRD Performance Requirements

EBRD Performance Requirement 1 requires assessment of social impacts as part of the impact assessment process. In addition, PR5 on land acquisition, involuntary resettlement and economic displacement requires the client to conduct a socio-economic baseline assessment on people affected by the project, including impacts related to land acquisition and restrictions on land use.

It is noted however that the Project will not trigger PR5 due to no expected physical or economic displacement of populations or individuals.

AfDB Requirements

Socio-Economic factors are required for inclusion in Environmental & Social Assessment. In accordance with Operational Safeguard 1: *'The borrower or client gives particular attention to assessing the risks and potentially adverse impacts of the project on local communities, including direct and indirect impacts on their health or safety and indirect impacts on their socioeconomic conditions and livelihoods. The borrower or client establishes preventive and management measures consistent with good international practice as described in the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).'*

IFC Performance Standards

IFC PS 1 standard establishes requirements for the assessment of social risk and impacts associated with the project which by virtue includes a need to assess socio-economic impacts.

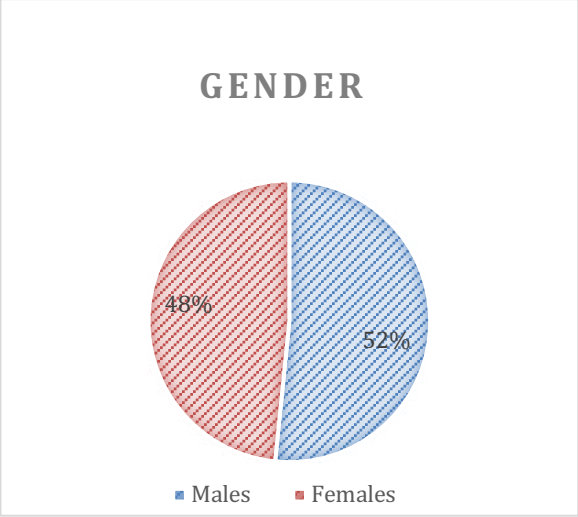
13.3 Baseline

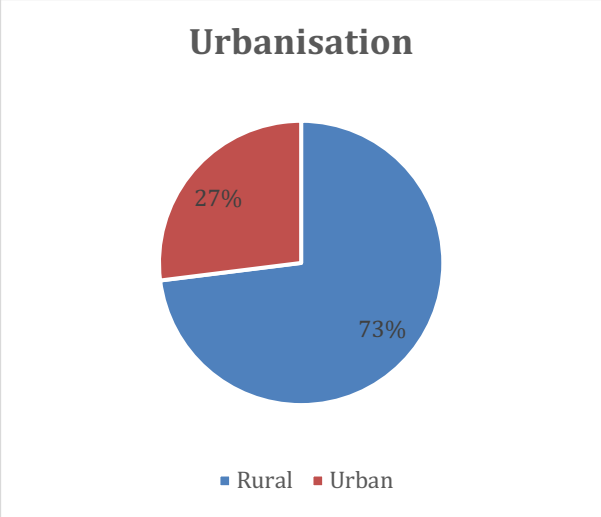
Population and Demographics

According to census data from 2017, the population of Aswan Governorate reached 1,532,400 residents. Kom Ombo, on the other hand, was estimated to have a total population of 400,140 in 2019; of which 52% are males and 48% are females. The majority of the Administrative Center is of rural nature, with the urban part being mostly semi-urban[8]. The figure below represents the Kom Ombo population's gender breakdown and the level of urbanisation.

[8] Published census data is that of 2006. 2019 data are calculated estimates. http://citypopulation.de/php/egypt-admin.php?adm2id=2806. *Retrieved on 15 Feb, 2020.*

Figure 13-1 Gender and Urbanisation Estimates



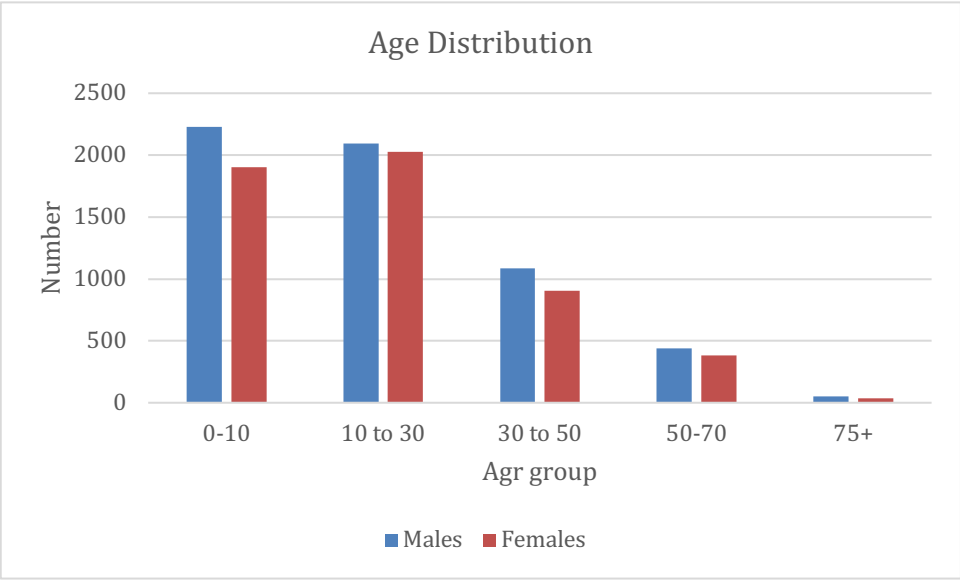


According to 2017 census data from CAPMAS, the population of Faris reached 11,151 residents; with males representing 43% of the population and females 53%. The table below presents demography of Faris. Similar to the rest of Egypt, the majority of Faris's population is made up of children and youth; with the highest age-group being 0-10, closely followed by 10-30. The following figure presents the breakdown of Faris's population by age.

Table 13-1 Faris Population – CAPMAS, 2017

VILLAGE	TOTAL POPULATION	NO. OF HOUSEHOLDS	MALES	FEMALES
Faris	11,151	2,741	5,900	5,251

Figure 13-2 Faris Age Distribution – CAPMAS 2017



Employment

According to Mr. Serag El-Din, who is one of the community leaders and a former Parliament Member, job opportunities are quite limited, and the majority of villagers work in cultivation, mainly of mango, dates, and *doum palm (hyphaene thebaica')* – a type of tree that grows only in Upper Egypt. The remaining population works as employees in the service sector, e.g. teachers, local council employees, among others. Employees would still cultivate land in their free time. He also stated that the number of fishers in the village is very small, and cannot be more than 2%. Recently, those with higher income, started to work as contractors to serve the new solar projects. While there are petroleum excavation activities at and near the village. The company involved – Dana Gas – is understood to have not employed any locals.

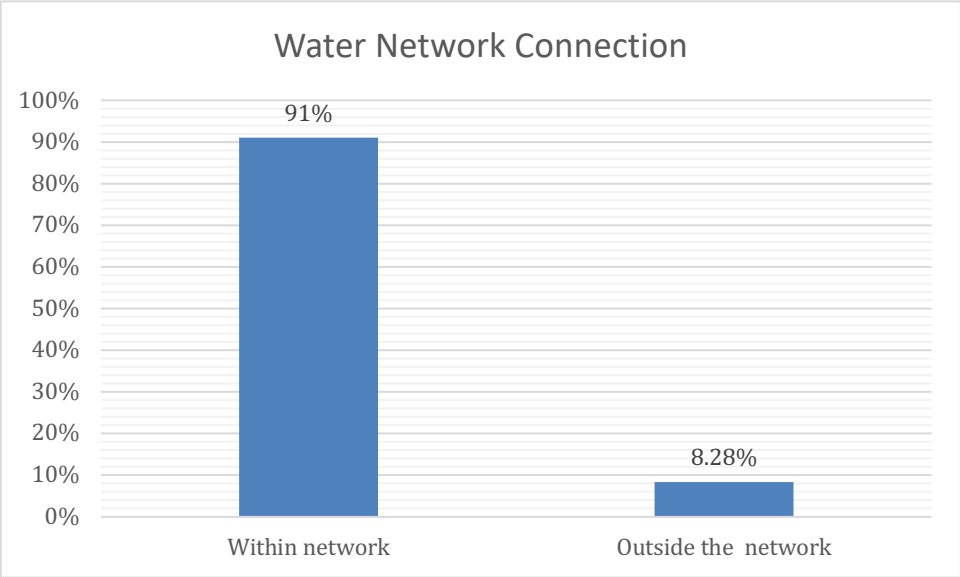
Available Infrastructure

Potable Water

According to CAPMAS data from 2006, more than 91% of Aswan's population are connected to the municipal water network, and 8.28% are not connected[9]. Figure 5 shows the total percentage of the population who are connected to the water network and those who are outside the network. The below data serves as an indication of the infrastructure of Aswan Governorate, however, data from recent years and from Kom Ombo and Faris village in particular are not available to draw a clear picture of whether more people have been included in the water network. According to conducted interviews and FGDs, the majority of participants indicated that they are connected to the water network, but also stated that the water is usually turbid and unclean, and thus cannot be used without filters.

[9] CAPMAS, 2006

Figure 13-3 Aswan water network, CAPMAS 2006



Sewage System

According to CAPMAS data from 2006, only 35% of the households in Aswan Governorate are connected to the municipal sewage network, 56% use communal pits, 7% are not connected to any type of sewage system, and 2% are connected to communal networks.

Participants of FGDs reported that the sewage system in Faris is non-existent, and the whole village relies on communal pits. Village inhabitants pay desludging expenses at their own cost. Sewage vehicles are called in at least twice a year and the user would pay around EGP 100 for every time they de-sludge. According to Mr. Serag El Din, sewage vehicles usually discharge in the desert or Nile near the village. Such practices are illegal, but nonetheless continue to happen.

Hazards of using communal pits include ground and surface water contamination, unpleasant odor, toxic gases, and dangerous effluents[10]. Such hazards have been confirmed by FGD participants who complained that contaminated groundwater frequently overflows, has flooded several locations in the village and penetrated houses, leading to walls cracking and consequently collapsing. During FGDs, an incident was reported as a result of this, where an 18-year old boy was killed due to a wall collapsing on him.

[10] https://en.wikipedia.org/wiki/Pit_latrine

Electricity

CAPMAS data of 2006, showed that 91% of Aswan's population are connected to the national electricity line. Only a small percentage, 8%, are not connected and the electricity connection of the remaining 1% is not clear.

Kom Ombo and Faris village are all connected to the national electricity line. FGD participants stated that usually they do not face power cuts, however, they complained that electricity bills are rather high (same prices paid all over Egypt).

Natural Gas

Faris is not connected to the natural gas network. Tanks are used instead.

Public Services

Security and Social Services

There is no security unit in Faris Village, or anywhere close to it. The closest police station is in Kom Ombo, which is across the Nile, and around 20 km away. There are several security checkpoints near the Village, on the Luxor-Aswan Western Desert Highway. These, however, are concerned with securing the road only.

The Ministry of Social Solidarity operates one Social Solidarity Unit in Faris Village. There are also four Civil Society Organisations (CSOs) in the Village. Three of those undertake social development and charity work and one is the Agricultural Association, which operates in agrarian reform and is responsible for purchasing pesticides and nutrients for all farmers.[11] However, according to one of the interviewed FGD participants, only three CSOs out four currently operate in Faris. The economic reform program, which is sponsored by the Egyptian Government, "*Takafol and Karama*" operates in Fairs village and provides conditional cash transfer to support unemployed people and people with disability.

Healthcare

There are two public healthcare units in Faris Village. According to the focus groups participants, however, these healthcare units do not offer the majority of healthcare services, nor do they have sufficient specialized physicians. In fact, some participants stated that the healthcare units do not have any physicians most of the week, and thus remain closed. The

[11] LC office data, 2016

only active public healthcare service in Faris is a Women' Heath Unit. However, it provides limited services and the physician is also not always present.

The nearest Hospital is Kom Ombo Hospital, which lies around 23 km away from town and involves crossing the Nile River by a ferry boat. There are four pharmacies in town, according to data provided by the Local Council Office. Specialized hospitals are located in Aswan, 80 km away from Faris. There is no ambulance station in Faris, but there is one station on the highway near Benabn Village, around 20 km away from Faris.

According to FGD participants, villagers felt that they have inadequate healthcare services, and have thus decided to build a private healthcare unit. They have thus funded the construction and operation of a small unit, which mostly offers dialysis services. It was understood from interviews with the Local Council Head and Mr. Serag El-Din, as well as FGDs that kidney failure is the most prevalent health issue in the Village, and this is why villagers needed to build the dialysis unit. The unit is fully funded by Villagers and provides its services with a low cost.

The table below provides an overview of the healthcare facilities present in Kom Ombo and Faris[12]:

Table 13-2 Healthcare services in Faris and Kom Ombo

LOCATION	GENERAL HOSPITAL	PRIMARY CARE	AMBULANCE STATION	AMBULANCES
Kom Ombo	1	40	4	7
Faris	None	None	None	None

Figure 13-4 Private healthcare unit

[12]Yearly Statistical Book, Aswan Governorate, 2013

Education

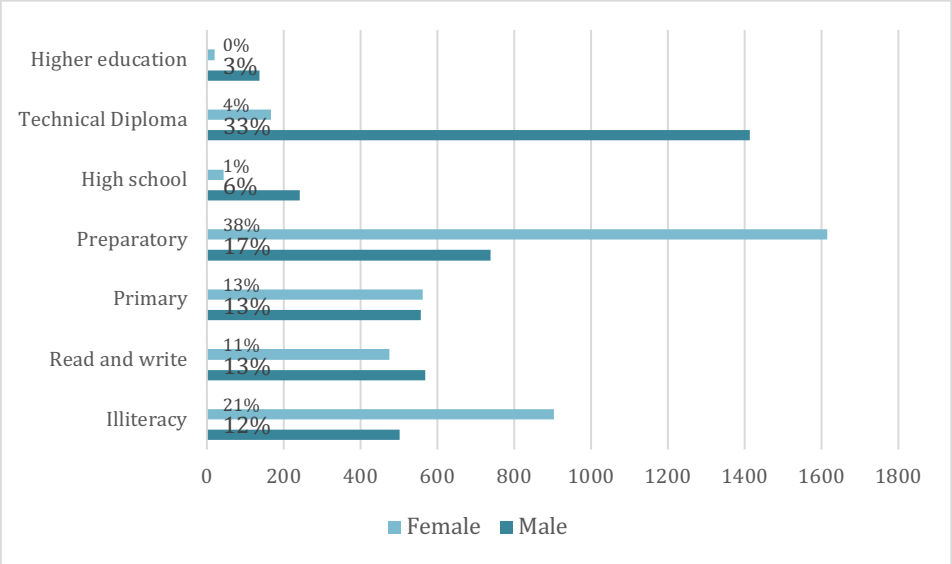
In terms of education, 2017 census data shows that 83% of the residents of Faris received some education, whereas 17% of the community are illiterate. Literacy rates of Faris village, however, are higher than the Egyptian national average for the same year, which stood at around 71%[13].

Males are generally more educated than females; of the illiterate population in Faris, 64% are females and 36% are males. Furthermore, the majority of males received either preparatory (middle school) or technical education, while the majority of females either could read and write, received primary education, or received preparatory education. The figures below illustrate the breakdown by gender and education levels. According to Focus Group participants, the main reason for men receiving more education than women is the unavailability of schools and teachers for girls in the village, especially secondary and technical. Thus, educating girls may mean that they have to send them to schools in Kom Ombo, which they fear may be unsafe for young girls. The other option would be to send them to the village school, which offers classes to both boys and girls. They also feel that this would be unsafe for their daughters. Finally, given that there are no or very few employment

[13] http://uis.unesco.org/en/country/eg

opportunities for women, villagers feel that there wouldn't be any benefit in educating their daughters.

Figure 13-5 Education Levels in Faris



According to the Mr. Serag El Din and FGD participants, there are eight schools in Faris; three primary, two preparatory, one secondary, one technical school and an Azhari school (Islamic education), with primary, preparatory and secondary levels. Male FGD participants complained that schools are understaffed and parents volunteer to teach school children to cover for the shortage in teachers. Furthermore, classrooms can have as much as 75 students. Another issue raised by female FGD participants is that – since there are insufficient classrooms – younger students go to school on evening shifts. Parents feel that this is unsafe for their young children, since it is cold and dark in the winter.

Recreational Activities

There is one youth center in Faris Village, yet, according to interviewed participants, it lacks activities to engage the youth.

Markets and Shops

According to female FDG participants, villagers are able to buy their food from small shops and kiosks or street vendors who come several times a week to Faris. However, to purchase other items, such as clothing or other essentials, they would have to take a ferry boat to Kom Ombo.

Traffic and Public Transportation

The main means of transportation in Faris Village are private cars – which are not easy to find, tricycles, auto rickshaws, and quarter trucks – which people use to go outside the Village. In order to go to Kom Ombo, villagers use the ferry boat to cross the Nile. Local inhabitants reported that they use more than one means of transportation to move around and to go to Kom Ombo. While not expensive, they feel that it is somewhat inconvenient, especially since they would have to go there for healthcare services, essential shopping, among other reasons.

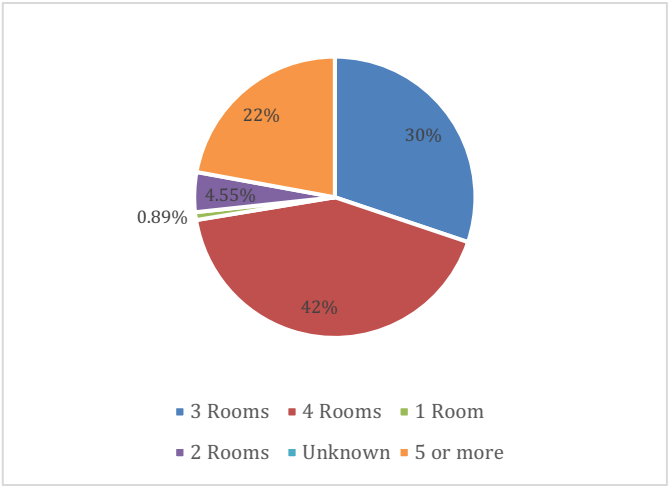
The Faris village is connected to the Luxor-Aswan Western Desert Highway via two roads. The older, northern road (18.5 km) links with the village's main road via the Ramadi El-Qibli - El-Raqbaa secondary road. The new, southern road runs more or less parallel to the older road and 3 to 5 km to the south of it. This wider, modern highway will cross the Nile, about 3 km south of Faris through a bridge, which is currently under construction. The Ramadi El-Qibli - El-Raqbaa runs just west of Faris and parallel to the Nile, connecting villages and towns on the western bank of the river.

Housing and Land Ownership

According to CAPMAS statistics from 2006, almost 94% of people in Aswan reside in dwellings with three or more rooms. The figure below shows the breakdown of number of rooms per dwellings in Aswan Governorate.

In terms of house ownership in Faris, the majority of houses are built and informally owned on government-owned land. Locals stated that they were required to pay a monthly rent for their houses to the government, given that they are built on government-owned land. However, the government is now looking into legalizing their ownership and is requiring them to pay a larger yearly amount to legalize the ownership of the land.

Figure 13-6 Number of rooms per residence in Aswan, CAPMAS, 2006



There are several types of housing in Faris, depending on when they were built, and the income level of the owner of the dwelling. Lower income residents usually build a small one-bedroom

dwelling for the whole family (mother, father, children, and possibly grandparents). High income villagers usually build the traditional Upper Egyptian houses, which are one floor with an open area in the middle and several rooms with domes around it. The houses are built that way to allow for more ventilation and cooler internals in hot summer days. Some newer houses are built as three-floor buildings, with more of an urban style.

Figure 13-7 Local houses in Faris village

Economic Activities

The main economic activity in Kom Ombo is tourism and tourism-related services, followed by agricultural activities. As for Faris, the main economic activity is agriculture, followed by cattle breeding. According to Mr. Serag El-Din, there are very few employees in the public and private sector and very few (around 2% of Faris population) are fishers. Furthermore, Aswan is popular for horse races and horse shows. Faris – Arabic for knight – is the most popular village in Aswan for Arabian Horses breeding and is understood to have the best horses in the Governorate. Most high-income residents have their own stables and take part in all horse shows and races.

Tourism

Aswan governorate is characterized by several touristic spots that makes it an international destination for tourists. It is an open museum for many archeological landmarks, which date back to various ages and spread all over the Governorate. This is especially so in the winter

season due to Aswan's moderate weather. In February 2017, Aswan's hotel occupancy rate surged up by 50%, indicating an increase in tourism activities[14].

Of the main touristic spots in Aswan, is the temple of Kom Ombo, which serves as the main touristic attraction in Kom Ombo. The temple of Kom Ombo is further discussed in the Cultural Heritage Section.

Agriculture

Kom Ombo is known for being mostly agricultural land. The main crop cultivated in Kom Ombo is sugar cane, followed by other crops such as wheat, barley, onions and fruits. The total cultivated land, according to 2015 CAPMAS statistics, is more than 229 thousand feddans. [15]

Faris village is known for its arable soil and good temperature that aids the cultivation of crops. It is well-known for large-scale cultivation of three main types of fruits/crops: 1) Mango, 2) Dates, and 3) Doum Palm[16].

Gender Equality

The Faris women the team has consulted were mostly students and housewives by choice. Women interviewed stated that, in general, girls would like more opportunities in education and employment. According to participants, girls do not go to school due to lack of proper means of transportation. Interviewed females stated that they are keen to work if suitable employment opportunities are available that wouldn't involve them leaving their houses or their village.

Figure 13-8 Waiting for women to join the female FGD in Faris

[14] https://egyptindependent.com/aswan-hotel-occupancy-rate-tops-57-february/
[15] CAPMAS, 2015
[16] https://www.marefa.org/%D9%81%D8%A7%D8%B1%D8%B3%D8%8C_%D9%83%D9%88%D9%85_%D8%A3%D9%85%D8%A8%D9%88#.D8.A7.D9.84.D8.A7.D9.82.D8.AA.D8.B5.D8.A7.D8.AF.Retrieved on 16th of Feb,2020

Indigenous People

Population in Kom Ombo is mainly divided into two groups; Aswani inhabitants and inhabitants who moved to Kom Ombo from nearby governorates, such as Qena and Sohag, for work purposes. No indigenous people are present in Egypt, however, there are some vulnerable groups who have unique cultures and traditions. In Aswan, there are two vulnerable groups, Nubians and Bisharis. There are no villages for any of these groups in Kom Ombo.

13.4 Sensitive Receptors

Figure 13-9 Potential Socio-Economic Receptors

RECEPTOR	SENSITIVITY	JUSTIFICATION
Education	**Medium**	Literacy rates are higher than the Egyptian average in the local area, although there are few primary school leavers that progress to high school and higher education.
Local / Regional Economy	**Medium**	Tourism and Agriculture are the key economic drivers in Faris and elsewhere in Aswan. There is little diversity for other markets.
Employment Market	**Medium**	The employment market locally is not diverse and there are locals in Faris who are unemployed. The Faris Contractors Union have established a temporary base close to the Project in order to gain work at the on-going adjacent TSK solar plant construction site.
Public Welfare & Social Services	**High**	Local population in Faris have limited public, social and recreational services, with the majority of such services (i.e. police, access to healthcare, hospitals, recreation) being across the Nile in Kom Ombo.

RECEPTOR	SENSITIVITY	JUSTIFICATION
Transport Network	**Low**	The transport network to and in and around the project site is hard standing roads.
Female Populations	**Medium**	It is evident that local women are keen to have increased involvement in employment, as well as educational opportunities. However, there are some barriers that are restricting this.

13.5 Potential Impacts, Mitigation, Management & Residual Impact

Employment and Economics

The primary economic impact during construction is likely to result from limited project timeline centric employment creation during this phase. This project is expected to create employment opportunities during the construction phase for unskilled and applicably skilled workers. Although not confirmed at this stage, ACWA Power project's typical process for employment consider the availability of local talent in the first instance as well as the use of relevant contracting companies (for applicable sub-contractor works). As well as the direct monetary uplift to the families of those employed, money paid to workers will also stimulate the local economy via the multiplier effect, whereby money earned on the project expended locally will re-circulate within the local economy.

Education and Skills

In addition to the direct monetary impact of employment created during construction, there also exists the potential for the project to promote the dissemination of construction and construction support skills from expatriate workers into the local labour force.

Local Economy

A secondary impact is likely to arise from spending on local and foreign goods and services during the construction process. The nature of the development, and specialised nature of required materials, suggests that these will be sourced internationally, apart from construction materials (e.g. concrete, bricks, fencing, cabling, etc.).

Gender

There may be opportunities to offer female employment in specific roles, although these will likely require a higher level of safeguards and specific provisions for encouragement (e.g. buses from Faris to site for females etc.).

Indigenous People

There are no ethnic minorities, indigenous peoples or internally displaced people in the project area, or nearby.

Pubic Welfare, Social Services and Recreation

The Project will not specifically result in direct uplift of such social provisions (particularly where responsibility for such services falls under government), however, given the increased activity from the project and elements for some influx of workers to the area, it is possible that some opportunities for improvements to this may be realised.

There may be opportunities for the Project to offer some services through corporate social responsibility type activities.

Traffic and Transportation

The construction period will result in an increase of vehicles entering the Project site, which are all expected to gain access from the Faris – Luxor Road 1 (ref. Figure 2-5), via the Luxor – Aswan Desert Highway to the west.

Construction vehicles will include a variety of vehicle classifications, e.g. HGV's, LGV's, trucks, pick-up trucks, excavators and other heavy/light equipment. Based upon past experience with solar PV sites, there will be a large continuous number of deliveries of project components (including PV modules, tracker units etc.).

Traffic flows on the Fairs -Luxor Road 1 are very low (the site surveys only observed a couple of vehicles every 10-minute period). Construction phase traffic may therefore result in a noticeable variation from current flows on this road, although there is unlikely to be a noticeable difference to flows on the highway.

Table 13-3 Socio-Economics Impact Significance, Mitigation & Management Measures and Residual Impacts-Construction

Potential Impact	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Employment Opportunities	**Minor Positive**	Employment Market	Medium	**Minor Positive**	• The Project Company will need to develop A HR Policy that outlines key employment processes for the Project. This should include: ○ Contractors should seek to prioritize the employment of local workers (populations from Faris Village and also Kom Ombo) where possible and where skills are available locally. • The EPC and Sub-Contractors HR Procedures will be prepared to ensure alignment with the Project Company policy and consistent with local labour laws and international ILO and UN conventions. • The EPC Contractor is to ensure that this is applied as an overarching policy for all sub-contractor company HR policy as part of their contractual arrangements.	**Minor Positive**
		Female Populations	Medium	**Minor Positive**	• Considerations for employment of local females for certain roles – including considerations of methods to reduce barriers to working (e.g. transportation to site etc.).	**Minor Positive**
Training and dissemination of construction skills	**Minor Positive**	Education	Medium	**Minor Positive**	• All project workers will receive induction training at the project, as well as vocational specific training for on-site construction works. • All workers will receive training in regard to health and safety, as well as environmental awareness. • Toolbox talks will be conducted before work on each day to ensure workers are reminded of key topics. • Cultural awareness training for all foreign workers.	**Minor Positive**
Purchase of construction materials locally	**Minor Positive**	Local / Regional Economy	Medium	**Minor Positive**	• Contractor to purchase goods and materials from the local/regional economy where possible.	**Minor Positive**

Potential Impact	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Increase in construction traffic on the Faris – Luxor Road 1	**Minor Negative**	Transport Network	Low	**Negligible to Minor Negative**	• Construction access roads to be clearly signalized. • Minimise the number of construction road movements as much as practicable. E.g. maximize the capacity of vehicles - Buses should be used and carpooling should be encouraged. • Staggering deliveries to the site will ensure that congestion on local and site roads is minimised, whilst reducing waiting times for drivers and over demand on receiving staff at the site. • Designated roads will be made clear to the drivers and signs for the directions and speed limit will be placed all along the roads. • Drivers to be fully competent and authorised to drive heavy loads vehicles and to receive specific training	**Negligible to Minor Negative**
CSR Opportunities	**Minor Positive**	Public Welfare & Social Services	High	**Minor to Moderate Positive**	• Project CSR activities can look to add value to public services (examples could include health care screenings, recreation, training centers etc.).	**Minor to Moderate Positive**

13.5.1 Operational Phase

At a strategic level the operation of the solar plant is a proactive measure towards a low carbon transition for Egypt's economy harnessing the abundant solar radiation in the country. This project will reduce Egypt's dependency on fossil fuel generated power and will reduce atmospheric pollution; in comparison to other power generation technologies in the current energy mix of Egypt. It will also support the continued growth of the national economy through the provision of sufficient power supplies in Egypt.

As with the construction phase, an economic impact during operation will result from any local employment created by the project. The operational phase will however require significantly less staff than during construction. Besides management and technical operator positions, the majority of staff will be security teams, panel cleaners and other office-based support staff. Such non-technical staff will likely be sourced locally based on ACWA Power's typical processes and observed track record of this in Egypt and for other projects in the MENA region. Whilst the size of the required workforce is significantly smaller, the type of work and the increased time-scales involved offer an opportunity for greater dissemination of skills. A targeted system of local recruitment and investment in the human capital of the local workforce will enhance this process and consequently increase the benefit to the local economy.

Table 13-4 Socio-Economics Impact Significance, Mitigation & Management Measures and Residual Impacts-Operation

Potential Impact	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Employment Opportunities, facilitating development and dissemination of skills	**Minor Positive**	Employment Market	Medium	**Negligible to Minor Positive**	• The projects recruitment policy will ensure a preference for employing workers from the local population where appropriately skilled workers are available locally (or if unskilled positions are available). • The HR Policy will be prepared to ensure consistency with the ACWA Power corporate policy which will ensure compliance with local labour laws and international ILO and UN conventions. • Workers will be encouraged to develop their careers and may be provided with opportunities to attend training courses and other career development processes. • Training plans to be developed and implemented to facilitate career development and advancement within the local workforce.	**Negligible to Minor Positive**

13.6 Monitoring

The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan'.

Table 13-5 Socio-Economic Monitoring Requirements (Construction and Operations)

MONITORING	PARAMETER	FREQUENCY & DURATIONS	RESPONSIBILITY
Employment	Number of persons employed from the local population	On-going	HR Dept.
Vehicles	Traffic related issues & incidents, including near misses	On-going	H&S Dept.
CSR	Records of CSR plans and activities	On-going	CSR responsible party
Third Party Grievances	Issues concerning socio-economic factors	Ref. to Grievance Mechanisms section in Stakeholder Engagement Plan (SEP)	

14 LABOUR AND WORKING CONDITIONS

14.1 Introduction

This section focuses on the welfare, working conditions and occupational health and safety related impacts associated with the construction and operational phases of the Project.

14.2 Standards and Regulatory Requirements

14.2.1 National Requirements

The Minister of Manpower and Emigration oversees the execution and implementation of Labour laws in Egypt. The principal low governing the protection of workers in Egypt is based on Law 137 of 1981 and its executive decrees, however the new Labour Law No 12 of 2003 was recently promulgated which supersedes many of the policies outlined in the Law no.137/1981 policies. This includes certain stipulations and standards for the working environment and the welfare of labour including but not limited to:

- General provisions on labour and working conditions,
- General working conditions,
- Wages;
- Contract termination;
- Leaves;
- Vocational guidance and training;
- Collective association;
- Child labour; and
- Female labour.
- Members of their Families.

The International Labour Organisation (ILO) sets guidelines and requirements relating to labour relations and workers' rights. Egypt has ratified in total 64 Conventions, of which 62 are in force. The list of conventions ratified can be accessed through ILO website: https://www.ilo.org/dyn/normlex/en/f?p=1000:11200:15473941022331::::P11200_INSTRUMENT_SORT:2.

In addition to the above, the following laws are also set the guidelines and regulation in terms of labour codes, general labour and employment acts (Ilo.org, 2020):

- Law No. 180 of 2008 amending Certain Provisions of the Labour Law No. 12 of 2003.
- Law No. 90/2005 amending some provisions of the Labour Law (Law No. 12/2003).
- Labour Code (No. 12 of 2003) and Law No. 180/2008 amending several provisions of the Labour Code (No. 12 of 2003).
- Order of the Ministry of Manpower and Training, No. 167 of 1996 to amend Ministerial Order No. 32 of 1989 concerning the use of the funds received because of the commitment of violations of the provisions of the Labour Code.
- Order of the Ministry of Manpower and Immigration No. 139 of 1996 to amend Ministerial Order No. 32 of 1989 concerning the spending of the amounts of money received as fines for violating provisions of the Labour Code.
- Decree (No. 29 of 1982) concerning administrative departments involved in the application of the Labour Act (No. 137 of 1981).
- An Act to promulgate the Labour Code. No. 137.

14.2.2 Lender Requirements

EBRD

The notable PR's that will apply to this project include:

- Performance Requirement 2: Labour and Working Conditions;
- Performance Requirement 10: Information Disclosure and Stakeholder Engagement.

In line with EBRD requirements 'Projects are required to comply, at a minimum, with (i) national labour, social security and occupational health and safety laws, and (ii) the fundamental principles and standards embodied in the ILO conventions (EBRD, Performance Requirement 2, 2014).'

AFDB

OS 5: Labour Conditions, Health and Safety – *'This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights and protection from abuse or exploitation. It covers working conditions, workers' organisations, occupational health and safety, and avoidance of child or forced labour.'*

IFC/World Bank Requirements

The following applicable IFC Performance Standards aim to identify and ensure that social and economic impacts of a project are addressed in the relevant areas, in particular:

Performance Standard 2: Labour and Working Conditions

- Equal opportunity and non-discriminatory HR Policies and procedures appropriate to the size of the workforce;
- Provision of clear documented terms of employment and worker rights to all staff; including sub-contractor staff;
- Provision of suitable labour accommodation (in accordance with the provisions of IFC & EBRD Guidelines on Worker Accommodation);
- Implementation of a robust Occupational Health & Safety plan; and
- Implementation of a grievance mechanism to ensure internal grievances can be raised in an easily accessible, understood and transparent process.

In accordance with IFC Performance Standard 2 (Labour and Working Conditions) there is a requirement to align with the following conventions:

- ILO Convention 29 on Forced Labour;
- ILO Convention 105 on the Abolition of Forced Labour;
- ILO Convention 138 on Minimum Age (of Employment);
- ILO Convention 182 on the Worst Forms of Child Labour;
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 111 on Discrimination (Employment and Occupation);
- UN Convention on the Rights of the Child, Article 32.1;
- UN Convention on the Protection of the Rights of all Migrant Workers.
- EBRD

14.3 Baseline

Any construction or industrial project will introduce health and safety risks associated with the use of plant, machinery and construction/operational processes. Risks can be severe depending on the type of activities required, materials used and site condition.

For projects in isolated locations and/or where the local population/skill sets require influx of people from other regions/countries consideration will need to be given associated with accommodation, welfare, sanitary provision, health care, hygiene, food potable water etc.

However, for the Kom Ombo PV Power Project, it is most likely locals from the nearby Faris Village will be contracted for the construction phase of the Project. In the event more workers are required, locals from near-by villages will be utilised. The locals in BenBan village have already developed the skills due to their involvement in the Benban PV Solar Park Project. Therefore, influx of people from other countries and regions are not expected for this Project.

14.4 Sensitive Receptors

The sensitive receptors will be the workers involved in the construction and operation of the Kom Ombo PV Power Plant.

14.5 Potential Impacts, Mitigation, Management & Residual Impact

14.5.1 Construction Phase

Occupational Health and Safety

Common activities undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals, etc. can all introduce significant risk to the health and safety for the associated work force. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards.

The type of hazards attributable to a construction site will vary significantly dependent on the construction methods employed and the degree of control implemented by the EPC and affiliated sub-contractor. It is therefore of the utmost importance that the EPC and affiliated sub-contractors demonstrate consideration of health and safety risks as part of their chosen construction methods and that these risks are appropriately mitigated.

As occupational health and safety is a risk rather than a potentially defined impact, its significance has not been assessed further in this ESIA. Health and safety risks to the site force should be managed through effective risk assessment, development and implementation of an Occupational Health & Safety (OH&S) Plan.

Working Conditions

Labour exploitation on construction sites unfortunately has become a reality in some parts of the world. An inequality in income, education and opportunities has led to opportunistic immoral practices with labourers and site staff suffering as a consequence.

To ensure the wellbeing of the staff associated with the project, the EPC and associated subcontractors will need to plan for necessary provisions relative to the requirement of the required workforce. This includes appropriate labour accommodation plans and mechanism for inspections and corrective actions.

The EPC Contractor shall adhere to good practice measures regarding worker welfare on and off site particularly in terms of sanitation facilities on site, and having adequate checks and balances regarding timely payment of salaries and having necessary redressal access in case of forced retrenchment.

As with occupational health & safety risk, worker conditions are a defined aspect of site planning rather than a potentially environmental impact as such, its significance is not assessed further in this ESIA. Risks associated with worker welfare during construction will be managed through effective project planning, and the enforcement of fair and just treatment throughout the construction phase.

Table 14-1 Labour and Working Condition Mitigation & Management Measures – Construction

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Occupational Health and Safety	• Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. • Chemicals and Hazardous materials should only be handled by trained personnel and personal protection equipment (gloves, face mask, nose mask, etc.) will be provided. • Workers will be informed of the chemicals that are hazardous to health or flammable and must be trained on handling such chemicals. • The EPC Contractor will implement and maintain an OHS management system taking into account specific risks associated with the project, legal requirements and duty of care. • The EPC Contractor will be responsible for ensuring that all affiliated sub-contractors comply with the Occupational Health and Safety (OHS) management system. The OHS management system will be in-line with recognised international best practice and as a minimum, this plan will include: - Means of identifying and minimising, so far as reasonably practicable, the causes of potential H&S hazards to workers. - Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. - Provision of appropriate equipment to minimise risks, and requiring and enforcing its use. - Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. - Documentation and reporting of occupational accidents, diseases and incidents. - Emergency prevention, preparedness and response arrangements - Communication of Health & Safety aspects to expatriate workers on the project site through signages in the language of the workforce for comprehensive understanding.
Workers Conditions- Terms of Employment, Non-discrimination and equal opportunities, Working Relationships	• The EPC contractor will provide a plan detailing how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. • Employment relationship will be on the principle of equal opportunity and fair treatment, and will not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. • The EPC contractor will not make employment decisions on the basis of personal characteristics, such as gender, race, nationality, ethnic origin,

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. • The EPC contractor will document and communicate to all workers their working conditions and terms of employment including their entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity/paternity, or holiday). • The EPC Contractor will base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to all aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, accommodation, access to training, promotion, termination of employment or retirement, and discipline. • *Special measures of protection or assistance to promote local employment opportunities or selection for a particular job based on the inherent requirements of the job which are in accordance with national law, will not be deemed discrimination.*
Workers Conditions- Forced Labour	• The EPC contractor will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements. • HR policies and procedures will be adapted appropriately to the size of the workforce required for the Project. Policies and procedures must be prepared to demonstrate consistency with the requirements of national legislation, EBRD PR2 and 10, AFDB requirements and IFC PS 2.
Workers Conditions- Child Labour	• The EPC contractor will comply with all relevant national laws provisions related to the employment of minors. • In any event, the client will not employ children in a manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development in line with EBRD PR2 and 10, AFDB requirements and IFC PS2. • Young people below the age of 18 years will not be employed in hazardous work and all work of persons under the age of 18 will be subject to an appropriate risk assessment
Workers Conditions- Wages, benefits, conditions of work and retrenchment	• Wages, benefits and conditions of work offered should, overall, be comparable to those offered by equivalent employers in the relevant region of that country/region and sector concerned. • The HR Management System for the company employees, contractors and sub-contractors will be aligned with EBRD PR2 and 10, AFDB requirements and IFC PS2. • If the EPC contractor anticipates collective dismissals associated with the proposed project, the EPC contractor will develop a plan to mitigate the adverse impacts of retrenchment, in line with national law and good industry practice and based on the principles of nondiscrimination and consultation. Without prejudice to more stringent provisions in national law, such consultation will involve reasonable notice of employment changes to the workers' representatives and, where appropriate, relevant public authorities so that the retrenchment plan may be examined jointly in order to mitigate adverse effects of job

Potential Impact	Mitigation and Management Measures
	losses on the workers concerned. The outcome of the consultations will be reflected in the final retrenchment plan.
Workers Conditions- Grievance Mechanism	• The EPC contractor will provide a grievance mechanism for workers to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hiring, and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.
Workers Conditions- Supply Chain	• The Contractor will devise a supply management system to ensure the measures above are implemented by any sub-contractors. • Accommodation to workers should follow international/regional good practices for worker welfare. Access to drinking water and toilets should be rendered on site.

14.5.2 Operational Phase

Occupational Health and Safety

The risks associated with the operational phase of the project are anticipated to be significantly less than during the construction phase due to reduced site activity and requirements for heavy plant and machinery. In spite of this, there will be specific risks related to electrical safety, hot areas (around panels) that will need to be managed; amongst others.

There will be occupational health and safety risks attributable to the operational phase associated with maintenance and inspection requirements. Maintenance and inspection will also require the use of site vehicles and activities that pose risks to human health and safety.

The severity and likelihood of risks during the operational phase will be dependent on the frequency and requirements for planned and unplanned maintenance. The operation and maintenance team will need to ensure that a robust plan is in place to appropriately manage these risks.

Workers Conditions

No long-term accommodation requirements are anticipated for the project as staff during the operations phase are expected to find or be based in their own accommodation in Aswan or Faris. However, as with construction, operational activities will need to plan for and enforce lender requirements and relevant sections of Egyptian laws on just and fair treatment of operation and maintenance staff (including any engaged sub-contractors). Allowance will

also need to be made for site staff welfare facilities including sanitation, rest, recreational and medical facilities.

Table 14-2 Labour and Working Condition Mitigation & Management Measures – Operation

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Occupational Health and Safety	• Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. • Chemicals and Hazardous materials should only be handled by trained personnel and personal protection equipment (gloves, face mask, nose mask, etc.) will be provided. • The Project's Operator will implement and maintain an OHS management system specific to the operational phase taking into account specific risks associated with the project, legal requirements and duty of care. • The Project's Operator will be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system will be in-line with recognised international best practice and as a minimum, this plan will include: - Means of identifying and minimising, so far as reasonably practicable, the causes of potential H&S hazards to workers. - Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. - Provision of appropriate equipment to minimise risks, and requiring and enforcing its use. - Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. - Documentation and reporting of occupational accidents, diseases and incidents. - Emergency prevention, preparedness and response measures
Workers Conditions-Terms of Employment, Non-discrimination and equal opportunities, Working Relationships	• The O & M Company will provide a plan detailing how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. • Employment relationship will be on the principle of equal opportunity and fair treatment, and will not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. • The O & M Company will not make employment decisions on the basis of personal characteristics, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. • The O & M Company will document and communicate to all workers their working conditions and terms of employment including their entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity/paternity, or holiday). • The O & M Company will base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to all aspects of the employment relationship,

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, accommodation, access to training, promotion, termination of employment or retirement, and discipline. - *Special measures of protection or assistance to promote local employment opportunities or selection for a particular job based on the inherent requirements of the job, which are in accordance with national law, will not be deemed discrimination.*
Workers Conditions- Forced Labour	• The O & M Company will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements. - HR policies and procedures will be adapted appropriately to the size of the workforce required for the Project. Policies and procedures must be prepared to demonstrate consistency with the requirements of national legislation, EBRD PR2 and 10, AFDB requirements and IFC PS 2.
Workers Conditions- Child Labour	• The O & M Company will comply with all relevant national laws provisions related to the employment of minors. • In any event, the client will not employ children in a manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. - Young people below the age of 18 years will not be employed in hazardous work and all work of persons under the age of 18 will be subject to an appropriate risk assessment
Workers Conditions- Wages, benefits, conditions of work and retrenchment	• Wages, benefits and conditions of work offered should, overall, be comparable to those offered by equivalent employers in the relevant region of that country/region and sector concerned. - If the O & M Company anticipates collective dismissals associated with the proposed project, the O & M Company will develop a plan to mitigate the adverse impacts of retrenchment, in line with national law and good industry practice and based on the principles of nondiscrimination and consultation. Without prejudice to more stringent provisions in national law, such consultation will involve reasonable notice of employment changes to the workers' representatives and, where appropriate, relevant public authorities so that the retrenchment plan may be examined jointly in order to mitigate adverse effects of job losses on the workers concerned. The outcome of the consultations will be reflected in the final retrenchment plan.
Workers Conditions- Grievance Mechanism	- The O & M Company will provide a grievance mechanism for workers to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hiring, and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

Potential Impact	Mitigation and Management Measures
Workers Conditions- Supply Chain	• The O & M Company will devise a supply management system to ensure the measures above are implemented by any sub-contractors. • Accommodation to workers should follow international/regional good practices for worker welfare. Access to drinking water and toilets should be rendered on site.

14.6 Monitoring

The final monitoring methodology with specific monitoring details (i.e. locations, frequencies, durations, parameters etc.) will be developed in the specific 'Environmental and Social Monitoring Plan'.

Monitoring	Parameter	Frequency & Durations	Monitoring Locations
Construction & Operations			
Worker Contracts & HR	Records of contracts, payments, receipt of benefits, leave entitlements etc.	On-going	For all Project workers (direct staff) and oversight of sub-contractor staff dedicated to the project
Worker Welfare	Sanitation Facilities, Office Spaces, Welfare and Rest Areas	On-going	At all such facilities on-site
Quality of Accommodation	Inspection/internal audit of worker accommodation facilities vs. IFC & EBRD standards	Monthly (where there is dedicated accommodation)	All accommodation facilities provided to direct and full time sub-contracted labour.
OH&S Near Misses (involving external parties)	Any classified near miss	On-going	n/a
OH&S Emergency Situations and Incidents	Any classified emergency situation or incident	On-going	n/a
Grievances	Grievances received	On-going	As defined in the Stakeholder Engagement Plan (SEP)

15 CUMULATIVE IMPACT ASSESSMENT (CIA)

15.1 Introduction

EBRD requires the assessment process to consider the cumulative impacts of the project "*in combination with impacts from other relevant past, present and reasonably foreseeable developments as well as unplanned but predictable activities enabled by the project that may occur later or at a different location*" (EBRD, 2014).

IFC defines cumulative impacts as "those that 'result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones" (IFC, 2013). CIA is therefore the process of:

- Analysing the potential impacts and risks of proposed developments in the context of the potential effects of other human activities and environmental and social external drivers on the chosen Valued Environmental and Social Components (VECs) over time; and
- Proposing concrete measures to avoid, reduce, or mitigate such cumulative impacts and risk to the extent possible.

The purpose of a cumulative impact assessment is to determine how the potential impacts of a proposed development might combine cumulatively, with the potential impacts of other projects or human activities as well as natural stressors such as droughts or extreme climatic events.

The objectives and expected outcomes of a CIA process are as follows:

- Identification of Valued Environmental and Social Components (VECs) such as air, water, soil etc. that may be affected by the Project and the selected VECs the assessment will focus on;
- Identification of existing and reasonably anticipated and/or planned developments, as well as natural environmental and external social drivers, that could affect the selected VECs;
- Assessment and/or estimation of the future condition of selected VECs, as the result of the cumulative impacts that the development is expected to have, when combined with those of other reasonably predictable developments;
- Evaluation of the future condition of the VECs relative to established or estimated thresholds of VEC condition or to comparable benchmarks;
- Avoidance and minimization of cumulative impacts of the Project on the VECs; and
- Monitoring and management measures to ensure the VEC viability over the life span of the development or its impacts.

15.2 Identification of Valued Environmental and Social Components (VECs)

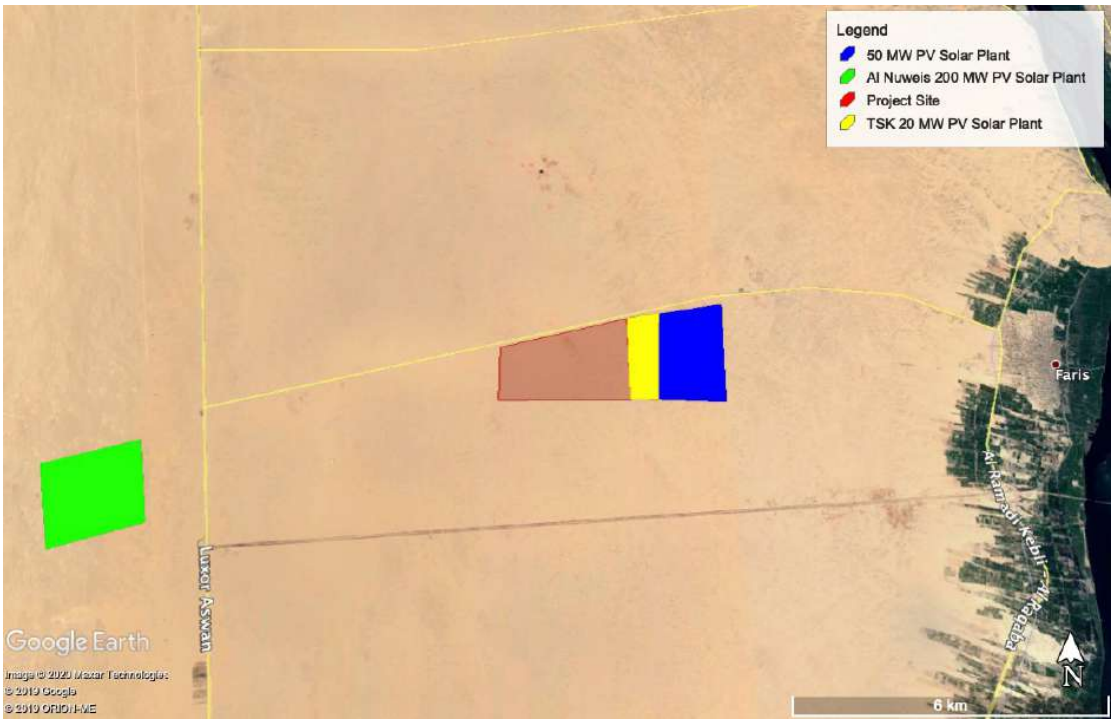
This ESIA has assessed cumulative impacts of several environmental and social parameters in the main sections of this ESIA. For instance, construction air quality (particulates), construction noise impacts, etc. have considered the measured baseline conditions in combination with the predicted process contributions. As a result, this has provided an assessment of cumulative impacts, as a result of the project itself and any cumulative impacts from existing neighbouring projects or emission sources.

15.3 Identification of Other Activities and Environmental Drivers

Based on published data by NREA and other sources, the following PV projects are known to be planned in Kom Ombo:

- 26 MW PV Solar Plant financed by ADF and owned by TSK and NREA, currently under construction. This plant is located adjacent to the kom Ombo 200 MW Project site from the east.
- 50 MW PV Solar Plant in cooperation with the Arab Fund for Development. This project is not developed yet and will be located adjacent to the TSK 26 MW PV Solar Plant from the east.
- 200 MW PV Solar Plant to be developed by Al-Newais Group and assigned by Presidential Decree No. 412 of 2016. This PV plant is located approximately 8 km west of the 200 MW Kom Ombo Project site.

Figure 15-1 Planned PV Solar Power Plants in Kom Ombo



Source: Google Earth Pro, 2019

Other type of developments in the area is currently unknown. However, few oil and gas drilling activities have been noticed in the area, but these will be outside of the Project's area of influence (refer to Chapter 2).

15.4 Assessment of Cumulative Impacts on VECs Due to Development of Project Area

Table 15-1 Summary of Cumulative Impacts (Qualitative Assessment)

RECEPTORS	CONSTRUCTION	OPERATION
Air Quality		
Impacts from Kom Ombo Project	During construction, local ambient air quality may potentially be affected by increased dust and by the exhaust fumes of construction vehicles, equipment and temporary power generators. Residual impact assessed as Negligible to Minor after (with mitigation measures)	None
Impacts from other PV Projects	Increases in dust and gaseous emissions due to operation of construction plant, equipment and vehicles. Residual impacts likely to be Minor following mitigation measures	None
Cumulative Impacts	The construction of the adjacent TSK PV Plant is almost complete. The timeframe for the other PV projects is unknown. No cumulative impact will occur if, as expected, the construction periods do not overlap. If the construction periods do coincide, cumulative impact on air quality with respect to dust generation and gaseous emissions from construction activities at the Project is anticipated. However, with the adoption of good management practises (mitigation measures) the cumulative impacts are expected to be minor.	None
Noise		

RECEPTORS	CONSTRUCTION	OPERATION
Impacts from Kom Ombo Project	Increases in ambient noise due to operation of construction plant, equipment and vehicles, assuming that they coincide.	None
Impacts from other PV Projects	Increases in ambient noise due to operation of construction plant, equipment and vehicles, assuming that they coincide.	None
Cumulative Impacts	No cumulative impact is expected if construction periods don't coincide. If construction period coincides, cumulative impact will occur at receptors within the area of influence which is defined as 2 km in this ESIA. Receptors within the area of influence may be temporarily impacted by the cumulative impact from Kom Ombo and the 50 MW PV Plant Projects if construction period coincides. The 200 MW PV Solar Plant to be developed by Al-Newais Group is located approximately 8 km west of the Project site and considered too far to result in a cumulative impact.	None
Soil, Geology and Groundwater		
Impacts from Kom Ombo Project	Impacts on soil and groundwater could arise from a number of activities including excavation and soil compaction, accidental spills or leaks, disposal. Residual impacts (with mitigation measures) have been assessed as negligible. Due to the depth of the groundwater at the wider area, it is not expected that any contamination will reach groundwater (Please refer to Section 7.3.6). There will be no additional pressure on the groundwater resources since water needed for construction will be supplied via water trucks (licensed water supplier).	Specific project impacts to soil, groundwater and geology are not expected during the operational phase. Potential risks of concern during the operational phase are expected to be limited to the management and storage of hazardous materials/ wastes/ wastewater, chemicals and fuels. There will be no additional pressure on the groundwater resources since water needed for operation will be supplied via water trucks (licensed water supplier).
Impacts from other PV Projects	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV

Receptors	Construction	Operation
Cumulative Impacts	Most likely the impacts will be localised and limited within each Project boundary, with very limited potential for cumulative effects. Therefore, the 200 MW Kom Ombo project in conjunction with the other PV Projects will not result in a significant cumulative impact on geology, soil and groundwater especially as groundwater resources will not be used.	None No additional pressure on groundwater resources.
Solid Waste & Wastewater		
Impacts from Kom Ombo Project	Construction of the project may result in the generation of rubble waste due to excavations, expected large volumes of recyclable PV module packaging wastes, and very small quantities of hazardous wastes (such as used fuel containers, spent paint cans, lubricant cans and oil cans, vehicle/plant maintenance wastes).	There will be relatively few waste streams, although defective PV panels and other maintenance wastes may be generated in small quantities on a continued basis. Other wastes will be minimal and varied, but may contain small quantities of hazardous components. Hazardous waste generated from the Project will most likely be transported by road vehicles for a long distance to the only hazardous waste facility available in Egypt located in Alexandria (approximately 770 km). However, this increase in transportation distances and the relatively small number of vehicle movements required to transport the waste is likely to insignificant.
Impacts from other PV Projects	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV
Cumulative Impacts	Disposal to landfills does have a number of environmental impacts including the production of methane (only from biodegradable organic waste), which is a greenhouse gas. The impact of landfill waste disposal from the Project will be cumulative.	Disposal to landfills does have a number of environmental impacts including the production of methane (only from biodegradable organic waste), which is a greenhouse gas. The impact of landfill waste disposal from the Project will be cumulative.
Terrestrial Ecology		
Impacts from Kom Ombo Project	The habitat identified at the project area is typical of all desert regions. Habitats of the Project Site and the Study Area are limited in diversity and coverage. The Project Site and the surrounding desert land is mostly	During operation, birds in proximity to the site are not expected to be impacted by the project directly, but may indirectly be attracted to the site under the influence of 'lake effect', a potential phenomenon whereby birds mistake the reflective

Receptors	Construction	Operation
	barren and supports a very little permanent animal and plant life. Uni-specific patches of the shrub *Salsola imbricate*, scattered throughout the site represent the only vegetation cover in the area. Wild fauna of the Project Site is limited to few insects and other arthropods, reptiles, occasional birds and small mammals and are common throughout the Western Desert of Egypt (identified as Least Concern under IUCN listing). Most of the resident birds of the project site and the surrounding area are true desert species and are typical of the Western Desert. Residual impacts have been assessed as Negligible.	surfaces of solar PV panels for the surface of water.
Impacts from other PV Projects	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV
Cumulative Impacts	Minimal increase in vegetation loss (mainly *Salsola imbricate)*. Typical desert vegetation such as *Salsola imbricate* will quickly re-establish after construction has been completed. This should be retained in areas of low activity such as near fence lines and boundaries and where there is little operational activity. Its ground cover will also provide benefit of reducing dust during desert winds	Typical desert vegetation such as *Salsola imbricate* will quickly re-establish in disturbed areas after construction has been completed. This should be retained in areas of low activity such as near fence lines and boundaries and where there is little operational activity. Its ground cover will also provide benefit of reducing dust during desert winds.
Cultural Heritage		
Impacts from Kom Ombo Project	There are no known or recorded sites of cultural importance (including tangible archaeological sites) in the Project area or the immediate vicinity or surroundings of the Project. However, there is still a potential for encountering unknown buried archaeology within the Project site during excavations. A Chance Find Procedure will ensure that any unexpected finds are not damaged and reported to the authorities.	None

Receptors	Construction	Operation
Impacts from other PV Projects	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV. A Chance Find Procedure for all PV Projects will ensure that any unexpected finds are not damaged and reported to the authorities.	None
Cumulative Impacts	Minor potential cumulative impact. There is still a potential for encountering unknown buried archaeology within the Project sites during excavations. This is mitigated by Chance Find Procedures.	None
Landscape and Amenity		
Impacts from Kom Ombo Project	Temporary visual impacts from dust generation during construction.	Permanent visual impact from presence of PV Power plant. Based on the viewsheds generated for the identified permanent receptors, the PV Power Plant will be most likely visible from the New Faris Village and accommodation camp. Due to the low-lying design of the PV Plant, views across the wider landscape are unlikely to be significantly impacted. The Project area may however be visible at night due to the addition of security and lighting at the entrances and along the perimeters.
Impacts from other PV Projects	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV for the project specific receptors.	Expected to be similar to the impacts identified for the Kom Ombo 200 MW PV for the project specific receptors.
Cumulative Impacts	No cumulative impact is expected if construction periods don't coincide. If construction period coincides, temporary cumulative impacts due to the generation of dust during construction activities.	The development of all of the PV Projects will include the installation of hundreds of thousands of PV panels which will alter the existing undeveloped desert landscape character of the project area to that of a sustainable renewable energy project site of low elevation.
Socio-economics		
Impacts from Kom Ombo Project	There are no ethnic minorities, indigenous peoples or internally displaced people in the project area, or nearby. Positive in terms of additional local employment and generation of renewable energy.	This project will reduce Egypt's dependency on fossil fuel generated power and will reduce atmospheric pollution; in comparison to other power generation technologies in the current energy mix of Egypt. It will also support the continued growth

Receptors	Construction	Operation
	Residual impacts have been assessed as Minor Positive to Minor to Moderate Positive.	of the national economy through the provision of sufficient power supplies in Egypt. Residual impact has been assessed as Negligible to Minor Positive.
Impacts from other PV Projects	Positive in terms of additional local employment and generation of renewable energy.	Positive in terms of additional local employment and generation of renewable energy.
Cumulative Impacts	Temporary increase in traffic during construction of the project and delivery of material and the workforce. Positive impact in terms of cumulative in increase in local employment.	Positive impact in terms of cumulative in increase in local employment.
Labour and Working Conditions		
Impacts from Kom Ombo Project	Project related impacts with regards to worker conditions and worker conditions (occupational health and safety) would mainly be those associated with construction and operation activities and will depend on conditions within the Project site as well as depending on Project-specific activities. Significant cumulative impacts with other ongoing projects are therefore not envisaged.	
Impacts from other PV Projects		
Cumulative Impacts		

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