DEWA Mohammed Bin Rashid Al Maktoum Solar Park – Phase V 900MW Solar PV IPP Dubai, UAE

Environmental and Social Impact Assessment

Volume 2 – Main Text, Tables & Figures

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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
CIA	Cumulative Impact Assessment
CESMP	Construction Environmental and Social Management Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Commercial Operation Date
CSP	Concentrated Solar Power
CWMP	Construction Waste Management Plan
dB (A)	A-weighted decibels
DEWA	Dubai Electricity and Water Authority
DM	Dubai Municipality
DSC	Dubai Statistics Centre
EPSS	Environmental, Planning and Studies Section
EC	Environmental Clearance
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EPs	Equator Principles
EPC	Engineering, Procurement and Construction
EPFIs	The Equator Principle Financial Institutions
ERP	Emergency Response Plan
HVAC	Heating, Ventilation and Air Conditioning
IFC	International Finance Corporation
IFI	International Financial Institution
ILO	International Labour Organisation
IUCN	International Union for Conservation of Nature
Leq (A)	A-weighted Equivalent Continuous Sound Level
MW	MegaWatt
NO_2	Nitrogen Dioxide
NRCS	Natural Resources Conservation Section
OESMP	Operational Environmental and Social Management Plan
O&M	Operation and Maintenance
PM_{10}	Particulate matter with an aerodynamic diameter smaller than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter smaller than 2.5 micrometres.
PPA	Power Purchase Agreement
PV	Photovoltaic
SO_2	Sulphur Dioxide
UN	United Nations
UNESCO	United Nations Educational Scientific and Cultural Organization
VOC	Volatile Organic Compounds
WHO	World Health Organisation
5 Capitals	5 Capitals Environmental and Management Consulting

1 INTRODUCTION

To ensure a sustainable supply of clean energy in the Emirate of Dubai, His Highness Sheikh Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE, and Ruler of Dubai launched the Dubai Programme for Renewable Energy in January 2012 and announced the Mohammed Bin Rashid Al Maktoum Solar Park, the largest single-site solar project in the world to enhance the sustainable development of Dubai.

The Solar Park aims to have a production capacity of around 5,000MW upon completion by 2030, aligning with the Dubai Integrated Energy Strategy 2030, which seeks to secure a sustainable supply of energy by diversifying Dubai's energy mix and increasing the use of clean and renewable energy sources to generate electricity.

The development of the solar park has been split into phases as follows:

- Phase I – a 13 MW solar photovoltaic (PV) plant which was successfully commissioned in October 2013 by DEWA;
- Phase II - a 200 MW solar PV plant which was successfully commissioned in April 2017;
- Phase III – an 800 MW capacity solar PV plant scheduled to be commissioned by April 2020; and
- Phase IV - a 950 MW CSP - PV Hybrid Power Plant scheduled to be commissioned by 2023.
- Phase V - a 900 MW Solar photovoltaic (PV) Plant, this Project

To meet the planned ±5,000MW production capacity of the Solar Park by 2030, the fifth phase of the Mohammed Bin Rashid Al Maktoum Solar Park, a 900MW solar PV project will be structured as an Independent Power Project to be developed on a BOO basis in three phases (300MW each phase). DEWA awarded the right to develop the Phase V project to a consortium of Saudi Arabia's ACWA Power and Gulf Investment Company (GIC).

Several Environmental Impact Assessment (EIA) documents have been prepared and approved for the Solar Park master plan and individual projects within the solar park. This has included an EIA for the original 1,000MW Solar Park master plan before an increase in the Solar Park's capacity to 3,000MW. An EIA for the 3,000MW Mohammed bin Rashid Al Maktoum Solar Park that included both PV and CSP technologies was prepared to cover all projects within the Park. This EIA was submitted to Dubai Municipality-Environmental Planning and Studies Section (DM-EPSS) on 7th November 2016 and obtained an Environmental Clearance (EC) on 27th November 2016 which was valid up to 30th November 2018 (EC No. 179/2016).

The Master Plan of the Solar Park was further revised on 21st March 2018, which included changes to the location of Phase IV CSP & PV project, as well as other future solar park phases, including Phase V. A new Environmental Clearance ((EC No. 034/2018) for the construction

and operation of a 3,843MW solar park utilizing Photovoltaic & Concentrated Solar Power technologies, was issued by Dubai Municipality-Environmental Planning and Studies Section (DM-EPSS) on 26th March 2018, and is understood to be based on the EIA prepared by Dome Consulting in November 2016. This Environmental Clearance was valid until 31st March 2020. On March 02, 2020, the EC (EPBI-170220-00226) was amended again for the construction and operation of a 5,013MW solar park utilizing Photovoltaic & Concentrated Solar Power technologies. The latest Environmental Clearance (EPBI-170220-00226) is shown in Appendix A

In line with the above-stated clearance for the 5,013MW PV & CSP Solar Park, and further communication with DM-EPSS, it has been determined that there is no requirement for a specific EIA to be prepared and submitted for the Phase V 900MW PV project as the technology and project footprint both fall within the scope and stated conditions of the valid Environmental Clearance.

It is however understood that ACWA Power is seeking Project finance from International Financial Institutions (IFIs) that may be signatories to the Equator Principles (a voluntary set of principles established to manage environmental and social investment risks), or have investment policies that are consistent with lending good practices and environmental and social standards, such as the IFC Performance Standards. As such, this Environmental and Social Impact Assessment (ESIA) has been prepared to align with the requirements of the Equator Principles, IFC Performance Standards and applicable World Bank Group EHS Guidelines. This includes the incorporation of applicable mitigation and management measures stated in the EIA which was prepared for the Environmental Clearance granted by DM-EPSS.

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 ESIA Terms of Reference (Ref. Appendix B) prepared by 5 Capitals specifically for the prospective lenders.

Given that the Phase V Project is already covered under the existing 5,013MW Solar Park clearance (EPBI-170220-00226) provided by DM-EPSS for all PV and CSP projects, there is no requirement for a DM-EPSS Environmental Clearance for the proposed Project. As such, this ESIA will not be submitted to Dubai Municipality and there will be no project-specific Environmental Clearance/Approval/Permit to be obtained.

The purpose of this ESIA is to align with lender E&S assessment and management requirements that were not covered by the scope of the wider solar park EIA and thereafter linked to the valid DM Environmental Clearance. The mitigation and monitoring measures stated in this ESIA supplement those that were developed in the original EIA, to ensure a comprehensive document that can be used as part of the implementation phase of the project.

1.1 Objectives of the ESIA

The objectives of this ESIA concerning this project include but are not limited to the following:

- Assessment of baseline conditions before the development of the project site through a review of available data and conducting surveys;
- Review of compliance obligations, including applicable federal, local and international regulations and standards as well as international lender requirements.
- Assessment of the Project's environmental & social impacts for the construction (including commissioning) and operational phases, including impact significance;
- Determination of applicable mitigation and management measures to be implemented to avoid or minimise potential impacts any comply with applicable requirements;
- Consideration of alternatives that can be used for the project leading to greater social and environmental gains; and
- The consideration of, inclusion and consultation with potentially affected stakeholders.

1.2 Structure of the ESIA

The ESIA has been prepared following good practice methodologies and is based on a similar format developed by 5 Capitals and used on other solar projects in the region. The structure of this ESIA is presented as follows:

- **Volume 1:** Non-Technical Summary
- **Volume 2:** Main Text, Tables, Figure and Plates
- **Volume 3:** Framework for Environmental and Social Management
- **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 3 provides a framework for the project to manage environmental & social risks and requirements for construction and operations, and how the outcomes of the ESIA should be implemented and managed in practice. This includes the development of the overarching environmental & social management system, including plans such as the Construction Environmental & Social Management Plan (CESMP) and the Operational Environmental & Social Management Plan (OESMP). The framework is designed to ensure consistency with the ESMS requirements stated in IFC PS1 and ACWA Power's internal HSSE Policies.

Volume 4 comprises of Appendices linked to this ESIA.

1.3 Key Project Information

Table 1-1 Project Information

PROJECT TITLE	DEWA Mohammed Bin Rashid Al Maktoum Solar Park – Phase V 900MW Solar PV IPP
PROJECT PROPONENT	Dubai Electricity and Water Authority (DEWA)
PROJECT DEVELOPER	ACWA Power
PROJECT COMPANY	Shuaa Energy 3 P.S.C
EPC CONTRACTOR	Shanghai Electric Group Co. Ltd.
OPERATION & MAINTENANCE COMPANY	The First National Operations & Maintenance Company (NOMAC)
ENVIRONMENTAL CONSULTANT	5 Capitals Environmental and Management Consulting PO Box 119899 Dubai, UAE Tel: +971 (0) 4 343 5955 Fax: +971 (0) 4 343 9366 www.5capitals.com
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1.4 Project Rationale

The Dubai Integrated Energy Strategy for 2030 was deployed by the Dubai Supreme Council of Energy in 2011 to set the strategic direction of Dubai towards securing a sustainable supply of energy and enhancing demand efficiency of water, power and fuel. His Highness Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, launched the Dubai Clean Energy Strategy 2050, to make Dubai a global centre of clean energy and green economy to provide 7% of Dubai's energy from clean energy sources by 2020 with an increasing target of 25% by 2030, and 75% by 2050. For this to be achieved, the Ruler of Dubai launched the Dubai Programme for Renewable Energy in January 2012 and announced the Mohammed Bin Rashid Al Maktoum Solar Park, the largest single-site solar project in the world to enhance the sustainable development of Dubai.

The Mohammed bin Rashid Al Maktoum Solar Park aligns with the Dubai Integrated Energy Strategy 2030 and aims to promote sustainability and preserve Earth's natural resources by using renewable resources in electricity generation, reduce their carbon footprint, create employment and training opportunities for UAE nationals, and facilitate the development of UAE expertise in solar and renewable energy.

2 PROJECT INFORMATION

2.1 Project Location

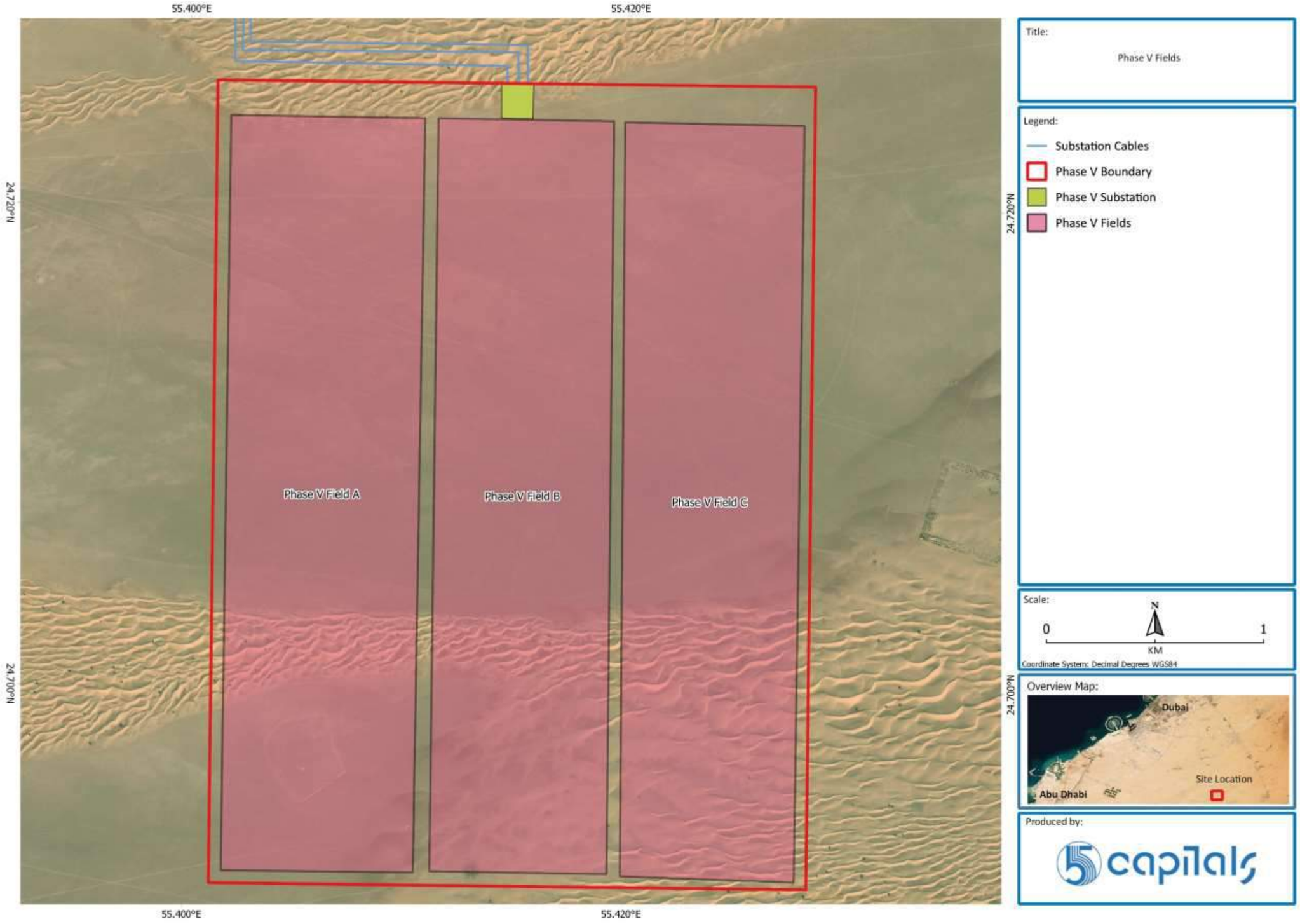
The Project will be located in the Saih al Dahal Area of Dubai, UAE, situated within the boundary of the Mohammed bin Rashid Al Maktoum Solar Park. The Solar Park is located about 53km south of the Dubai Creek, 21km south-east of Al Maktoum International Airport (Dubai World Central: DWC) and approximately 23km away from the Dubai-Abu Dhabi border.

Figure 2-1 Solar Park Location Within the Emirate of Dubai

The Phase V Project will have a rectangular shape (approximately 2,752m E-W x 3,696m N-S) with a total area of approximately 10.17km^2. The site's altitude is between 100 and 120 meters above sea level.

Figure 2-2 Project Location within the Solar Park Boundary

Figure 2-3 Overall Project Layout



2.2 Project Site Description and Existing Condition

2.2.1 Topography and Land Use

The location of the 900MV PV Phase V site is approximately 44km from Dubai inside the Al Marmoom Desert Conservation Area, the first unfenced nature conservation reserve in the United Arab Emirates. It is located in the desert area of Saih Al Salam in the emirate of Dubai and comprises some 10% of the total land area of the emirate, including the extensive man-made desert wetlands, Al Qudra Lakes. The Solar Park forms an integral part of the conservation area that is under Dubai Municipality management.

The project area consists of mostly gravel plains and is relatively flat. Towards the centre and the south-east, are some dunes that provide a slight increase in elevation. Dunal areas include locally protected Ghaf trees which tend to be located along dune ridges

The project area is known to be inhabited by several local and internationally important faunal species, including the Arabian Oryx (IUCN status - "Vulnerable"). An Oryx feeding station was previously observed in the southern area of the project area but has since been relocated off the project site.

Plate 2-1 Flat Gravel Plains

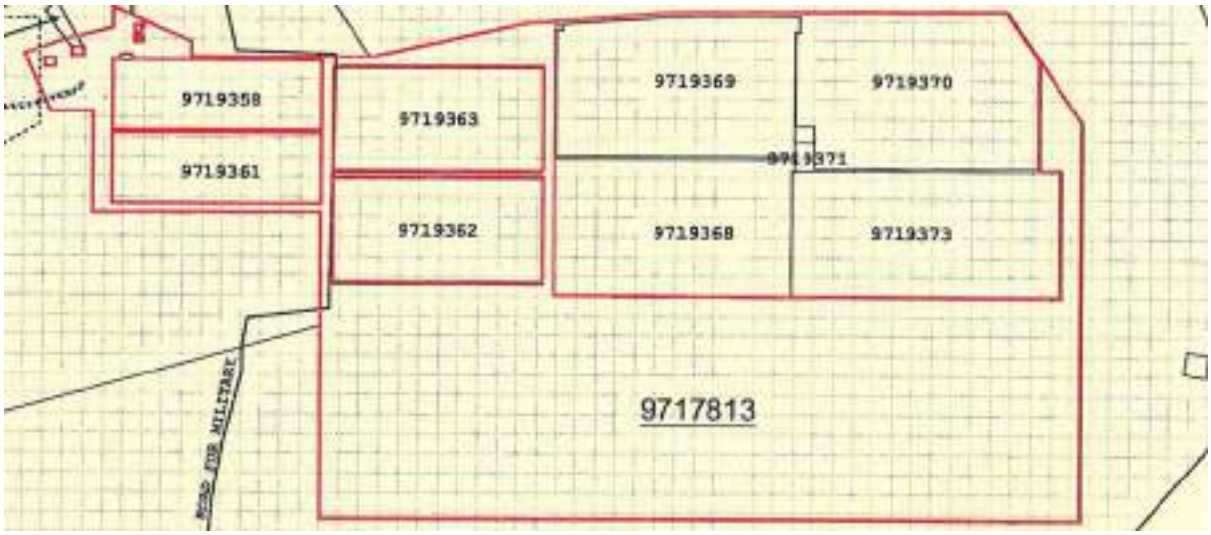
Plate 2-2 Sand Sheet and Dunes with Ghaf Tree

2.2.2 Land Ownership

DEWA owns the plot of land (Plot ID: 9717813) located almost 45 Km south of Dubai City within the Mohammed Bin Rashid Al Maktoum Solar Park. See figure below for an extract of the affection plan showing the plot location.

Dewa has granted the Project Company a Musataha interest in the allocated site which is the equivalent under UAE law of a leasehold interest, but unlike a leasehold interest, a Musataha interest is registerable in the UAE. The right also allows the Project Company to build and own the Plant on the site independent of DEWA's ownership of the land and will grant easements and rights of way over designated areas outside of the site boundaries. The complete affection plan can be found in Appendix C.

Figure 2-4 Extract from Affection Plan



2.2.3 Site Conditions and Local Context

LAND USE AND ACTIVITIES WITHIN THE SOLAR PARK

The Project site is located in an isolated area of the Dubai desert with few other land uses and activities taking place within the surrounding area.

The land uses and activities in the surrounding area were identified during the primary and secondary data collection phases undertaken for the ESIA. This included site visits, review of satellite imagery and review of previous EIA's undertaken within the surrounding area.

Several human and ecological features within and around the MBR Solar Park boundary have been identified. These features may potentially be impacted by construction and are considered potential receptors. Specific impacts on these receptors will be further discussed in the following chapters.

Table 2-1 Land Uses Within the Solar Park

Land Uses	Receptor Type	Distance from the Phase V Project Site
Phase I - 13MW PV Project	Industrial	Approximately 5.2km to the northern boundary of the Project site
Phase II - 200MW PV project		Approximately 3.3km to the northern boundary of the Project site
Phase III - 800MW PV Project - Field A		Approximately 1.9km to the northern boundary of the Project site
Phase III - 800MW PV Project - Field B		Approximately 2.4km to the northern boundary of the Project site
Phase III - 800MW PV Project - Field C		Approximately 440m to the northern boundary of the Project site
Phase IV - 950MW PV & CSP Project- Parabolic Trough 1		Approximately 3km from the south boundary to the northern boundary of the Project site
Phase IV - 950MW PV & CSP Project- Parabolic Trough 2		Approximately 1.3km from the south boundary to the northern boundary of the Project site
Phase IV - 950MW PV & CSP Project- Parabolic Trough 3		Approximately 5.5km from the south boundary to the northern boundary of the Project site
Phase IV – 950MW PV & CSP Project – Central Tower		Approximately 6km from the south boundary to the northern boundary of the Project site
Solar Innovation Centre	**Educational/ Commercial**	Approximately 5.4km to the northern boundary of the Project site
Research and Development Centre	**Commercial**	Approximately 5.8km to the northern boundary of the Project site
Al Marmoom Desert Conservation Area	**Commercial / Ecological**	Project located with the Conservation area
Ghaf Tree Nursery	**Agricultural**	Approximately 700m to the eastern boundary of the Project site
Farm	**Agricultural**	Approximately 2.8km to the eastern boundary of the Project site
Camel Farm	**Agricultural**	Approximately 8km to the eastern boundary of the Project site

Notable Land Uses in Proximity of the Solar Park

A limited number of isolated commercial and residential land uses were identified outside the Solar Park. The nearest residential area to the Solar Park is a private villa compound, known as the 'Falcon Majlis' and a small settlement incorporating a mosque. The area is located approximately 500m and 200m north from the Solar Park Boundary.

Just outside the Solar Park Boundary, there is a residential compound approximately 1.1km to the Northeast from the Solar Park.

Another residential compound is located approximately 10km north-west of the Solar Park boundary. Three (3) settlements called Al Lisaili, Murquab and Al Faqa are located approximately 18km north, 8km northeast and 9km east of the Solar Park boundary.

The Hadaybit Racing Stable and Bab Al Shams Desert Resort and Spa are approximately 10km and 14km to the north and northwest of the Solar Park respectively.

Table 2-2 Land Uses Outside of Solar Park

LOCATION	LAND USES	LAND USE TYPE	DISTANCE FROM THE PROJECT SITE
Outside the Solar Park	Residential Compound 1	Residential	Approximately 13.8km northeast of the Project Centre Point
	Falcon Majlis	Residential	Approximately 7.6km north of the Project Centre Point
	Mosque	Commercial	Approximately 7.6km north of the Project Centre Point
	Al Qudra cycling track	Recreational	Approximately 8.4km northwest of the Project Centre Point
	Residential Compound 2	Residential	Approximately 16.5km northwest of the Project Centre Point
	Al Lisaili Settlement Community		Approximately 26.6km north of the Project Centre Point
	Murquab Settlement Community		Approximately 20.8km northeast of the Project Centre Point
	Al Faqa Settlement Community		Approximately 21.2km east of the Project Centre Point
	Hadaybit Racing Stable	Commercial	Approximately 18.1km north of the Project Centre Point
	Bab Al Shams		Approximately 22.2km northwest of the Project Centre Point

Figure 2-5 Land Uses within and near the Solar Park

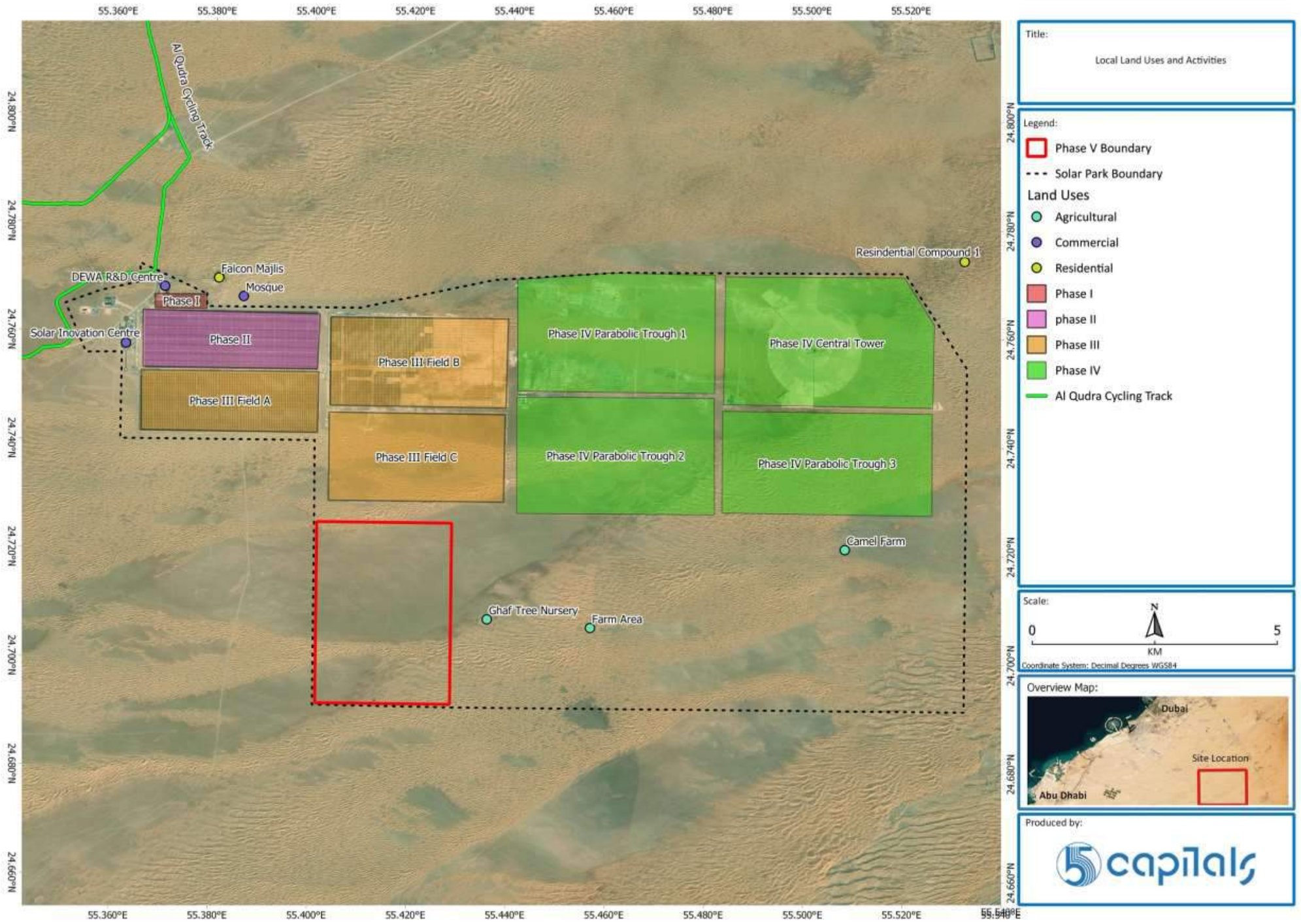
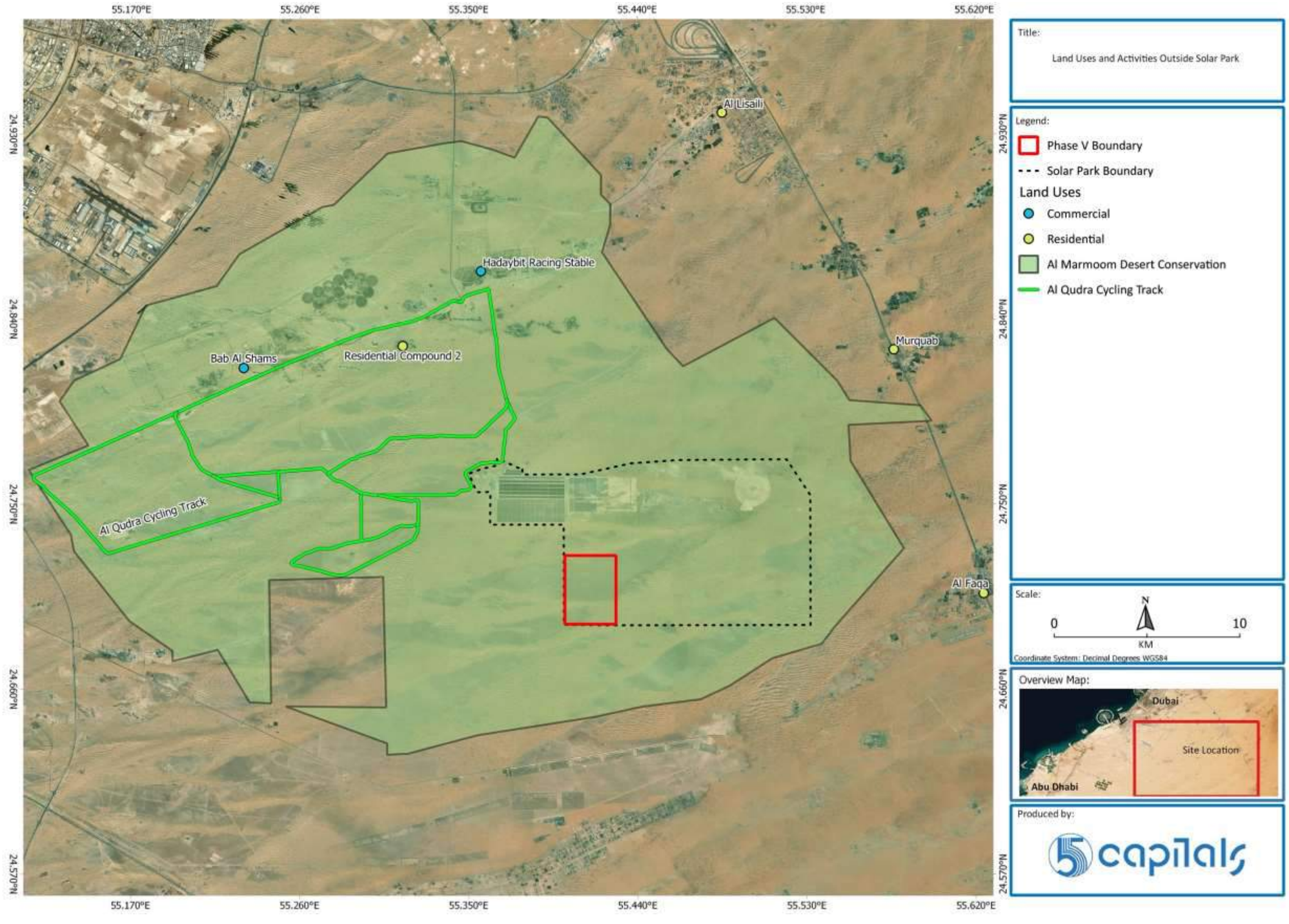


Figure 2-6 Land Uses Outside the Solar Park



2.3 Existing Solar Park Facilities

2.3.1 Solar PV & CSP Power Plants

PHASE I

DEWA's 13MW Phase I plant is located north-west of the Solar Park covering an area of 238,764m2. It is powered by 152,880 PV modules with electricity generating capacity of approximately 24 million kilowatts per year, providing electricity to 600 homes in Dubai via connection to the Dubai electricity grid.

PHASE II

The 200MW Phase II plant is located to the north-west of the Solar Park. This 200MW power plant has been developed based on the First Solar Thin Film technology, using cadmium telluride (CdTe) static PV modules.

PHASE III

The 800MW Phase III plant completed construction of its last solar field (C) and will combine as an 800MW Independent Power Plant (IPP) using crystalline silicon PV modules on trackers. It involves the development of one (1) 200MW and two (2) 300 MW PV power plants. When complete, the operations of the Phase III project are estimated to save up to 1.4 million tonnes of CO_2 equivalent emissions per year.

PHASE IV

The 950MW Phase IV project will include a combination of CSP and PV technologies which will incorporate specific fields for parabolic trough and solar tower CSP technologies, as well as solar PV areas. It is currently under construction.

2.3.2 The Solar Innovation Centre

'DEWA is working to develop an Innovation Centre, equipped with the latest renewable and clean energy technologies. Through this, DEWA aims to raise awareness on sustainability, while enhancing national capabilities and increasing competitiveness. DEWA's Innovation Centre will comprise of four stories, in addition to a ground floor, standing 90 metres tall. The project will be completed by Q1 2020. (DEWA, *https://www.dewa.gov.ae/en/about-us/strategic-initiatives/mbr-solar-park/innovation-centre*, Accessed on 30th January 2020)

2.3.3 Off-taker Substation

The Off-taker 400/132kV Shams Substation is located towards the north of the Solar Park and is currently under construction. The existing 400/132 kV MBR SOLAR substation will undergo the necessary extension works required for the Project's interconnection to the overhead transmission system.

2.4 Project Technology

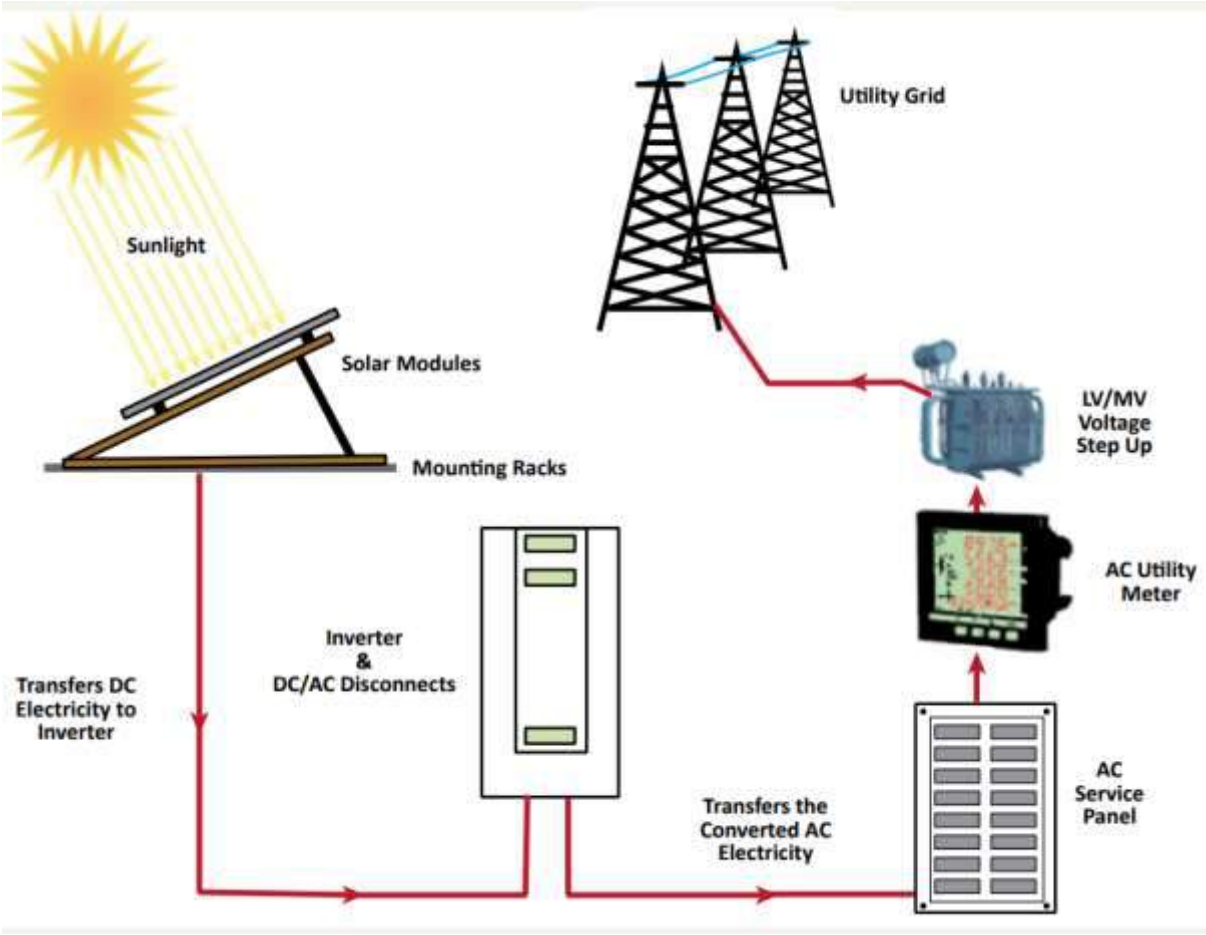
This Project will be using ground-mounted Photovoltaic (PV) technology using bi-facial modules installed on tracking ground-mounted racks arranged to ensure the most efficient alignment to capture solar radiation. The Project will have a minimum accumulated installed DC capacity of 900 MWp, commissioned as 300 MWp (Phase A), 300 MWp (Phase B) and 300 MWp (Phase C), respectively. The Maximum Power Output (active power) measured at the Electrical Delivery Point will not exceed 900 MW at any time. The units will be connected and export power through a 400/132 kV MBRSOLAR Substation that is built and operated by DEWA and a 400/132 kV SHAMS Substation that is currently under construction by DEWA.

PV OVERVIEW

Photovoltaic Power Plants make use of photovoltaic cells to generate electricity through the exposure to sunlight. This technology converts solar radiation into direct current electricity using a panel that exhibits photovoltaic effects. The 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 sun rays(photons) into electrons, these electrons, in turn, generate Direct Current electricity (DC), that are then connected to an inverter which converts 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: Used to convert solar radiation directly into electricity through the photovoltaic effect in a silent and clean process that requires no moving parts.
- Inverters: These are required to convert the DC electricity to AC.
- Module mounting: These allow PV modules to be securely attached 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.
- 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 2-7 Overview of PV Power Plant (International Finance Corporation, 2015)



2.5 Auxiliary Facilities

2.5.1 Internal Roads

Internal roads within the Project site will be developed such that it is adequate and suitable to connect to the road network to facilitate transportation of equipment to and within the site. Between the rows of PV modules, these will be compacted tracks and not paved.

2.5.2 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 the use of toilet facilities on-site. However, this is expected to be in relatively small quantities given the limited number of operational staff required. The wastewater will be collected in dedicated septic tanks and transported to approved and regulated wastewater treatment plants.

Panel cleaning will not generate any wastewater due to the use of dry automated robotic cleaning technology. It is possible that on occasions water may be used in certain areas for cleaning, however, under normal operations, this is not expected.

ELECTRICAL SUPPLY

The Project will primarily utilise its renewable electricity generated but as required will draw electricity from the grid when not generating (e.g. at night).

The Project will include an emergency diesel generator for use during emergency black-out situations only.

2.6 Associated Project Facilities

Associated facilities are those that are not funded as part of the Project and that would not have been constructed or expanded if the Project did not exist and without which the Project would not be viable.

2.6.1 Electrical Connection

The Plant will connect to and export its power through a 400/132 kV MBR SOLAR Substation that is built and operated by DEWA and a 400/132 kV SHAMS Substation that is currently under construction by DEWA (Offtaker Substation), located close to the Site. The Offtaker Substation operation and connection to the Transmission System will be the responsibility of the Offtaker. Interconnection between the Plant and the Offtaker Substation will be made through one 132 kV underground cable for each 100 MW and will be the responsibility of the Project. A maximum DC voltage of 1500 V shall apply for the plant design while functional grounding of the PV generator should be possible without additional works or equipment after Mechanical Completion.

Figure 2-8 132KV Substation at Phase V Northern Boundary

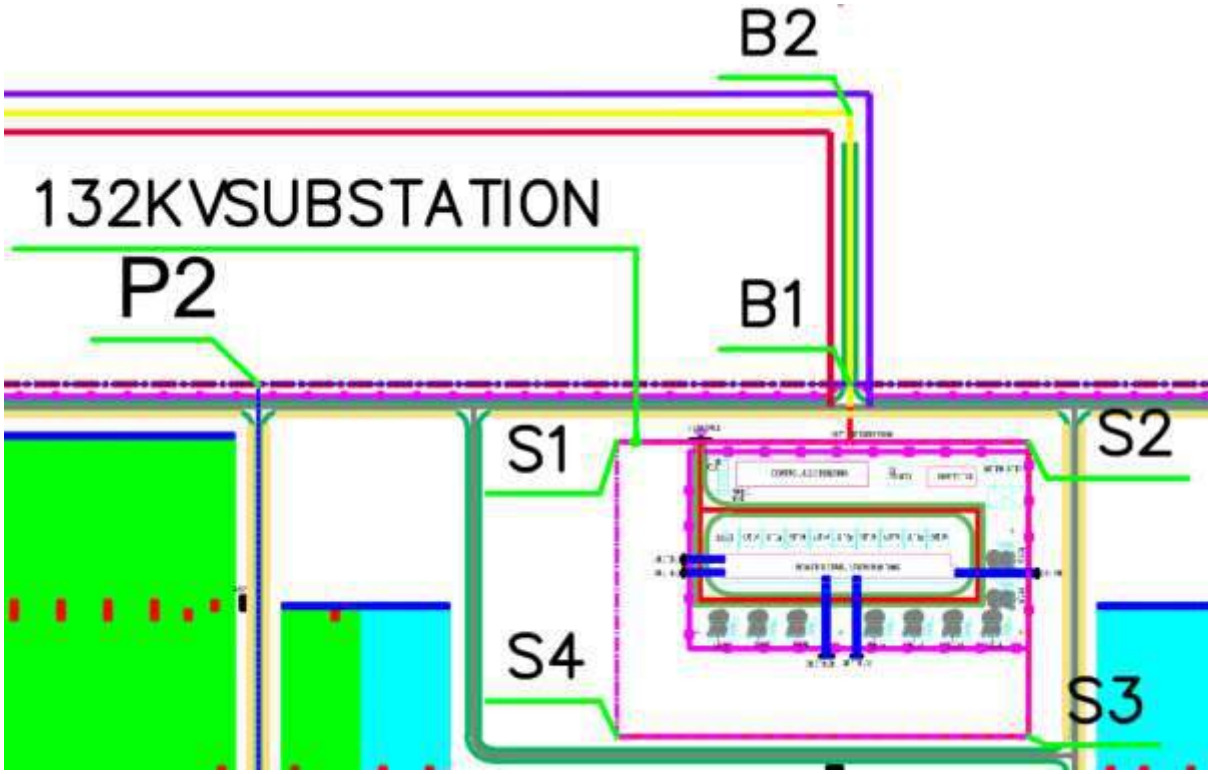
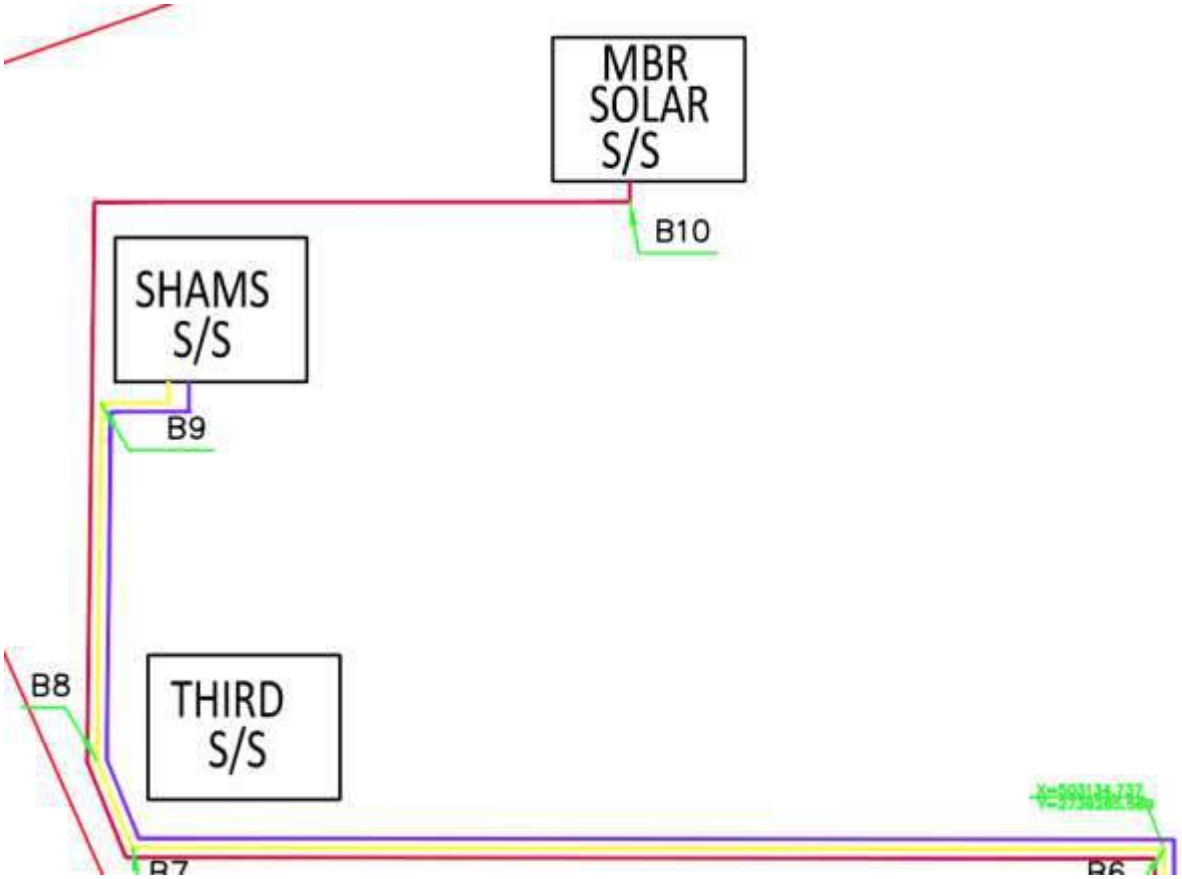


Figure 2-9 Connection to SOLAR and Shams Substations (Adjacent to Phase II)



2.6.2 Access Roads

The EPC Contractor will as part of the Project construct an Access Road that will then be managed by the Roads and Transport Authority (RTA). The access road will connect to an existing hardstanding road that is in place up to the DEWA Phase III Field A entrance.

The Access Road will follow the same general route as the electrical connections.

Figure 2-10 Access Road

2.7 Project Milestones

Outlined below are the main project milestones of each Field.

Table 2-3 Project Milestones

MILESTONES	DATE
Notice to Proceed	End of July 2020
Scheduled Commercial Operation Date – 300 MW Phase A	2 April 2021
Scheduled Commercial Operation Date - 300 MW Phase B	2 April 2022
Scheduled Commercial Operation Date - 300 MW Phase C	2 April 2023

2.8 Project Construction Requirements

China's Shanghai Electric has been awarded the Engineering Procurement & Construction (EPC) contract. As the EPC contractor, Shanghai Electric will be responsible for construction works and associated construction activities of the Project. There is an EPC Coordination Agreement with separate Construction and EP contracts. The principle construction activities for this project are related to infrastructure and civil works and mechanical and electrical works.

2.8.1 Primary Construction Works

Principle Project construction activities concerning infrastructure and civil works include:

- Site clearing of vegetation, levelling with compaction/consolidation, grading, earth and sand moving, soil improvement etc.;
- Construction or compaction of internal construction roads on-site;
- Water and electricity supply for Plant construction;
- Construction of distribution system, water system, security fencing and guardhouses, parking
- Construction of storage facilities for equipment and materials and temporary construction laydown area;
- PV tracker foundation drilling, installation of tracker supports, tracker system and PV panels;
- Foundations and installation of block transformers and connections inside the PV blocks;
- Construction of general buildings, such as administrative building, control room, workshops, electrical buildings, auxiliary buildings and structures, etc;

2.8.2 Construction Requirements and Facilities

TEMPORARY LAYDOWN/WORKING AREAS

According to the EPC Contractor, the preliminary planned main temporary office area and workshops will be located near the site substation. Other laydown areas for sub-contractors would be located in the area of each phase. These will all be within the site boundaries.

Although unconfirmed at this stage, laydown areas will likely be provided for each sub-contractor engaged at the Project. Such areas are expected to include some or all the following temporary facilities:

- Office spaces;
- Diesel generators and Fuel Storage;
- Waste storage (may include hazardous waste streams);
- Equipment storage;
- Toilets;
- Drinking-Water Stations;
- Rest shelters;
- Canteen/eating areas;
- Vehicles
- Vehicle Parking.
- Construction and other Material Storage (may include hazardous materials and chemicals)

MANPOWER REQUIREMENT

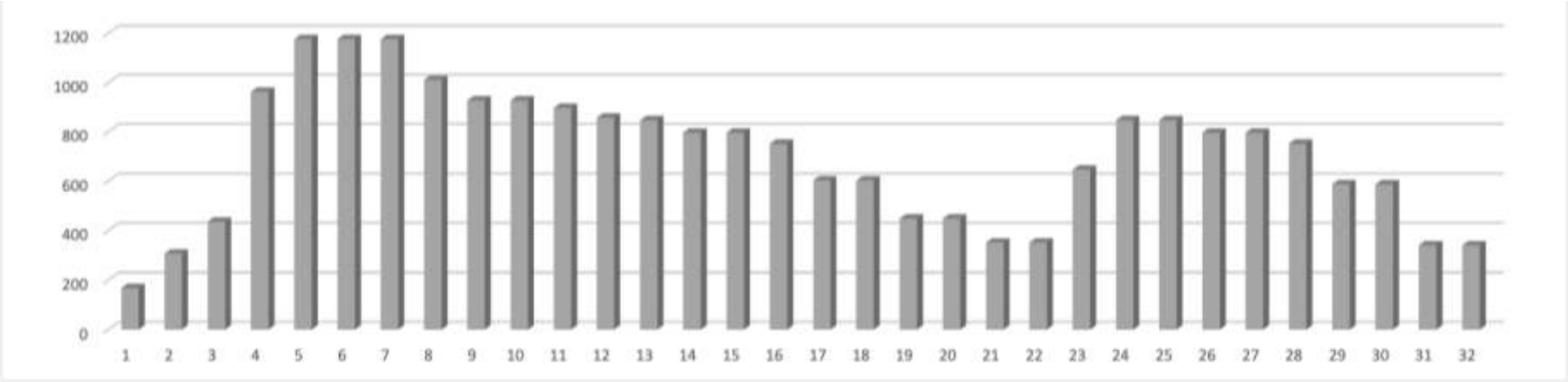
The estimated number of construction workers on-site during peak periods is expected to be around 800 to 1,000 workers. This will comprise a combination of EPC Contractor staff and sub-contractor personnel.

Impacts related to construction waste, wastewater, as well as requirements for working conditions, community health, safety & security and worker accommodation have been assessed in respective chapters of this report.

Figure 2-11 Workforce Breakdown During the Construction Phases

No.	Type	Phase A								Phase B												Phase C											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
—	SEC staff	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
—	Subcontractor staff																																
1	Management members	32	58	68	78	78	78	78	78	78	78	68	68	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	48	48
2	Civil workers	95	165	265	450	450	450	450	380	320	320	300	260	260	210	210	160	160	160	110	110	110	110	260	260	260	210	210	160	155	155	102	102
3	Mechancial&Electrical Workers	15	30	45	355	570	570	570	475	450	450	450	450	450	450	450	455	306	306	202	202	105	105	250	450	450	450	450	455	296	296	132	132
4	Service and Security	15	33	38	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	38	38
	Total	167	306	436	961	1176	1176	1176	1011	926	926	896	856	846	796	796	751	602	602	448	448	351	351	646	846	846	796	796	751	587	587	340	340

Figure 2-12 Workforce Breakdown During the Construction Phases - Histogram



WORKER ACCOMMODATION AND FACILITIES

There will be no dedicated workers accommodation on-site. It is however understood that several subcontractors will be hired; each having their respective workforce hence worker accommodation. It is expected that the majority of subcontractors will already have/establish accommodation areas in Dubai city. There are few large scale worker accommodation camps in proximity to the project site and therefore workers will need to be transported to and from the site daily. Wherever located, the standards of facilities for worker accommodation will be specified by the Project Company and will be following the IFC/EBRD Worker Accommodation Guidelines, as set out in the respective section of this ESIA herein.

Project site provisions for worker welfare such as canteens, sanitary facilities and transportation to and from the site will be the responsibility of the sub-contractors; but with overarching rules set out by the Project Company to align with IFC PS2 requirements.

UTILITIES

Potable Water

Potable water will be delivered to the site by a combination of bottled supply and/or by bulk tanker. Potable water will be the responsibility of and stored in each contractor/sub-contractor temporary compound areas respectively.

Non-Potable Water

Where required for construction processes, non-potable water will also be delivered to the site by tanker and stored in bulk at each contractor/sub-contractor temporary compound areas. The EPC Contractor has advised that water from boreholes will not be used (as is the case with other drilled boreholes for different solar park phases).

Fuel

Fuel for construction vehicles and generators will be delivered to the site in bulk by a tanker and if necessary (i.e. for generators and vehicle refuelling) stored in bulk at each contractor/sub-contractor temporary compound area. The expected amount of fuel to be used during construction are shown in the table below.

Table 2-4 Expected Fuel Consumption During Construction

FUEL TYPE	USAGE	QUANTITY
Diesel	Generators	2500 tonnes
	Construction Vehicles and Equipment	7000 tonnes
Petrol	Vehicles (Pickups and Small Vehicles)	100 tonnes

Electricity

The supply of electricity for construction will be provided using diesel generators, which will be managed and installed on mini-grids by the respective contractor/sub-contractor in their temporary construction compounds.

OTHER FACILITIES

Waste & Wastewater

Management of the Project's construction waste has not yet been confirmed, although it will either be managed by:

- EPC Contractor overarching collection and management of a centralised waste area / EPC Contractor management of wastewater.
- Sub-Contractor management and collection of both waste and wastewater.

Both options will require effective management of both waste and wastewater following the mitigation and management measures states in this ESIA. This includes the use of licensed contractors for collection and ultimate recycling/disposal or treatment at licensed facilities.

Concrete washout

It has been confirmed that the Project will not have a dedicated concrete batching plant on site, although (and unconfirmed at this stage) it is expected to include a dedicated concrete washout area for trucks post-delivery, as is typical on solar PV construction projects. This will either be in a common area or for the specific sub-contractor(s) undertaking the concrete laying. Where such a washout area is established, good practice mitigation measures to contain such wastewater are outlined in the chapter "8.2.4 Groundwater".

VEHICLES, EQUIPMENT AND HEAVY MACHINERY REQUIREMENTS

Contractors/Sub-contractors responsible for different construction activities within the site will make use of various kinds of vehicles, equipment and heavy machinery during the construction phase of the project. The specific details of equipment and numbers of each to be used on-site during the various phases of the project have been provided by the EPC contractor and are shown in table below.

Table 2-5 Vehicle and Equipment Expected on-site during the Construction Phases

Vehicle Type	TIMELINE (MONTHS)																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
		Phase A																														
			Phase B																													
	Phase C																															
Excavator	3	3	6	6	6	3	3	3	3	2	2	3	3	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	1	1	1	1
10T Roller	2	4	8	16	16	10	10	4	4	3	2	3	2	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	1	1	1	1
2T Roller	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
Bulldozer	3	8	16	20	20	12	12	6	6	2	2	3	3	2	1	1	1	2	2	2	2	2	3	3	1	1	1	2	1	1	1	1
Water Wagon	3	6	8	8	6	6	4	4	4	3	3	4	4	3	3	3	3	3	3	3	3	3	4	4	3	3	3	2	1	1	1	1
Mobile Crane	1	2	4	4	2	3	3	3	2	2	2	2	3	3	2	2	2	2	3	3	2	2	2	2	2	2	2	2	1	1	1	1
Truck mounted crane	1	2	3	3	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	2	2	2	1	1	1	1
Flatbed Trailer	1	2	2	2	2	2	2	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
Dumper	10	20	30	40	40	30	20	10	5	4	4	8	8	6	4	4	4	4	4	4	4	4	6	6	4	3	3	3	2	2	1	1
All-terrain Vehicle	10	20	20	30	30	15	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grader	3	5	10	10	10	10	10	5	3	2	2	3	3	2	2	2	2	2	2	2	2	2	3	3	2	2	1	1	1	1	1	1
Shovel	3	6	6	6	6	4	4	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
Concrete Mixer	0	0	0	3	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	6	6	6	6	6	6	6	6	3	3	2	2
Concrete Pump	0	0	0	1	2	2	2	2	3	3	3	2	2	2	1	1	1	3	3	2	2	1	1	1	3	2	2	1	1	1	1	1
Pile Driver	0	0	0	0	0	0	0	4	4	6	8	8	6	6	4	4	2	2	2	2	1	0	0	0	0	0	0	0	0	0	0	0
Fork lift	0	0	0	0	0	0	2	4	4	8	12	12	12	12	8	8	6	6	6	6	4	4	4	4	0	0	0	0	0	0	0	0
Constructin Personnel Transport Bus (Daily Average per month)	4	5	6	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	3	3	3	2	1
Constructin Personnel Cars (Daily Average per month)	12	16	20	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	24	16	16	10
Site visitor car (Daily Average per month)	3	4	5	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	5	5	5	5	5	4	4	4	3	2	2
Material Supplier Flatbed Trailer (Daily Average per month)	3	4	6	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	8	8	6	6	6	3	3	3	1	1
Service vehicle (Daily Average per month)	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4	3	3	3	2	2	2
Total	64	110	154	208	211	172	154	127	117	114	119	128	125	119	108	108	104	107	108	102	98	89	97	96	84	81	78	71	53	43	37	30

2.9 Projects Operation and Maintenance Requirements

The Project will be operated and maintained by NOMAC (The First National Operation and Maintenance Company). NOMAC operates under a corporate level Environmental Policy with a corporate framework for E&S Management.

The Project will be operational for a minimum of 25-years in line with the PPA, which has a 25-year term. At this stage, it will either be decommissioned, transferred or perhaps upgraded (such provisions for end of life are unknown at this stage).

Day to day operational activities are expected to include:

- Safe and efficient operation and maintenance of the Plant;
- Cleaning of PV modules (considering the manufacturer's requirements);
  - A waterless automated robotic cleaning system
- Safe and efficient operation and maintenance of the 132 kV underground cables and Protection and Connection Equipment;
- Maintenance of all civil, mechanical, and electrical components at least according to the manufacturer operation and maintenance manuals and instructions
- Maintenance of the security and SCADA & Telecommunication systems including the forecasting system as well as devices and measures to ensure cybersecurity all IT-based systems following the relevant standards and DEWA's Security-Cyber Security Requirements for Secondary Systems;
- Maintenance of auxiliary systems, fire detection, fire protection & firefighting systems;
- Maintenance of the weather stations;
- Maintenance of the Site in a good state; including removal of shifting and flying sand wherever required for an efficient, reliable, and safe operation of the Plant
- Monthly and annual reporting;
- Claims management; and,
- Coordination with Offtaker when needed.

2.9.1 Staffing Plan

The initial staffing plan consists of one (1) Electrical Engineer / Site Supervisor and Nine (9) Electrical Technicians.

During the operational phase, It is advised by NOMAC that there will be a remote operation of the plant through the M&PC Monitoring & Prediction Centre at NOMAC Dubai HQ with no control room operators (CCR) in the plant.

Table 2-6 O&M Staff Shift Plan

POSITION	NUMBER OF SHIFTS, ALL DAYS OF THE YEAR
Security personal	2 shifts of 2 operators, 12 hours per shift
Shift Technicians	1 shift of 3 Technicians, 8 hours. Two Shifts per day + 2 Technicians during office hours
Robots Maintenance Staff Operators	1 shift of 2 Technicians during office hours
Electric Engineer/Site Supervisor	During office hours

2.9.2 Water Supply and Usage

During the operational phase, water will be used for domestic and sanitation purposes and fire protection (in the event of an emergency). It is understood that the PV modules will be cleaned automatically without water using robotic cleaning. Routine cleaning of the modules is planned to be dry to the maximum extent possible to make the cleaning process fully environmentally and economically sound. The automated robotic cleaning system will be installed whereby a wiper automatically removes the dust without the use of water.

For sanitary purposes, the estimation is that a total amount of 900m^3 per year would be required for the project.

In case of emergency, the total demand for water for fire protection would be 400m^3/h for a maximum of 2 hours. All water will be supplied via a dedicated water tank and stored on-site and distributed via the fire fighting water pumping and suppression system.

2.9.3 Waste Generation

During the operational phase of the Project, a small amount of solid and liquid waste from maintenance activities will be generated, with the majority of these being non-hazardous.

A detailed description of wastewater treatment, disposal methods and management plan are contained in the waste and wastewater management section.

2.9.4 Vehicle and Equipment Requirements

The vehicle movement to and from the site will not be significant during the operations phase due to the small number of employees that will be on-site. The table below show all expected vehiles on-site during operations.

Table 2-7 Expected vehicle movent on-site during operations

VEHICLES EXPECTED	QUANTITY	USEAGE
O&M vehicles	several	Pickup trucks to be used continuously/daily by O&M staff (technicians, operators, engineers, etc.) to move around the solar field, between the different power blocks, between power blocks and common facilities, etc
Maintance Vehicles, heavy tractor, water truck, truck mounted crane, extendable boom forklift	several	When necessary, maintance vechiles will be used on-site.
Small forklift	5	To be used in each of the 4 power blocks (mainly for movement of chemicals), as well as in the warehouse and workshop. In the case of the warehouse and workshop, the expected use is daily within the warehouse/workshop premises. In the case of the power blocks, this might be weekly/bi-weekly.
Electric tricycles	10	To be used continuously on daily basis by field operators and maintenance technicians to move within the premises of each power block.
HTF evacuation truck	2	To be used mainly in the solar field for the drainage of solar field loops. Frequency might be weekly/bi-weekly.
Cleaning vehicles Aux. PV plant	7	To be used on daily basis during night for cleaning of PV panles of Auxiliary PV plants
Firefighting vehicles and ambulances	TBD	Several vehicles (number to be determined) normally parked in common facilities unless any emergency requires their use.

VEHICLES EXPECTED	QUANTITY	USEAGE
Employees vehicles	several	Regular employees will normally access the plant at the beginning of their duty and their cars will remain parked in the corresponding parking/plant until the end of the working day, when they will leave the plant. In those 2 movements, they will circulate to go inside/outside the plant. [there are 10 operational staff for this project so in extreme case consider 10 vehicles daily unless they decide to pool among themselves
Nitrogen supplier trucks	Service Provider	Nitrogen is a plant consumable that is stored in a nitrogen tank in each of the 3 power blocks of the 3 PT plants. It is expected to receive regularly (potentially daily) the unloading of liquid nitrogen required for PT plants process, which is received from a service provider in a tanker truck. Nitrogen is directly unloaded from the tanker truck to the nitrogen tank.
Waste disposal contractor	Service Provider	For both hazardous and regular waste, it is expected frequent disposal of waste, which is done by the collection of the same from a subcontractor. This might occur weekly/bi-weekly.
Deliveries for warehouse	Service Provider	The warehouse, located in the common facilities, is expected to receive deliveries (spares, tools, chemicals, etc.) very frequently (bi-weekly basis).
Security vehicles	TBD	Security services are subcontracted. As part of these services, security guards are expected to perform regular rounds around the plant.

2.10 Project Decommissioning Requirements

As stated in chapter 14 of the Musataha Agreement, unless a buy-out has occurred, the Musateh shall at its sole cost and expense, following good utility practice and applicable law remove the plant and any hazardous substances or residual waste. The site will be returned to the condition it was in at the Effective Date as evidenced by the Site Condition Survey.

Before the twenty-fifth (25th) year (as per the term of the Power Purchase Agreement) anniversary of the Effective Date, the Musateh will prepare a cost estimate to decommission the Plant which shall be submitted to Owner for approval.

Given that the decommissioning phase is not expected for at least 25 years from the Commercial Operation Date, there are no specific requirements provided for the decommissioning of the Project at this stage.

Currently, it is not considered practical to speculate on future environmental & 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 extent of environmental and social regulation that may exist.

Key considerations for eventual decommissioning will need to consider the management of large volumes of electronic waste as a key element from the Project.

Therefore, all impacts relating to the 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 before decommissioning and would be based on the projects ESMS.

2.11 Project Alternatives

As is consistent with good practice for Environmental Impact Assessment (to ensure that the objectives of the proposed project have accounted for social, environmental, economic and technological options) the evaluation of various project design and activity alternatives should be considered.

It is noted, however, that the Project location and design are based on strict land lease agreements for allocated land and minimal functional specification issued by DEWA (the Project Proponent). As such, there are few (if any) reasonably viable alternatives that ACWA Power can consider concerning the location and overall technology approach.

For this purpose, the following project alternatives were considered under a high-level assessment:

- No Project Alternative;

- Site Location; and
- Technology.

2.11.1 No Project Alternative

To meet with the Dubai Clean Energy Strategy 2050, a 'No Project Alternative' cannot be said to be a viable due to the integral part that the solar park development plays in this strategy, as well as the wider Dubai Integrated Energy Strategy and UAE obligations to the Paris Agreement. The development of both PV and CSP technology at the MBR Solar Park will contribute to ensuring that the Dubai Clean Energy Strategy 2050 target of providing 25% of Dubai's energy from clean energy sources by 2030 and 75% by 2050 is maintained.

2.11.2 Site Location

DEWA commissioned a feasibility study in 2009 on the potential development of a centralised solar power plant in the Emirate of Dubai. The feasibility study explored different aspects for the development, including site selection and allocation, technology options, associated environmental issues and economic aspects.

Fifteen (15) potential sites within the Emirate of Dubai were investigated for the development of a solar power plant and four (4) sites were shortlisted, including the proposed site for the development in Saih Al Dahl area. This site was selected based on its size, suitability of existing topography and its proximity to the existing electricity grid. As referenced previously, the exact location of the Phase V project was amended in March 2018.

Given the existing level of infrastructure (associated facilities) that has been developed in the solar park area (i.e. transmission lines, substation, roads etc.) the development of the Phase V project in this area is subject to these existing benefits and does not require the development of new infrastructure in other areas. As such, the environmental and social impacts of the projects associated facilities are minimal and maintained at this location.

The consideration of an alternative project location would, therefore, be costly to the project and could potentially result in additional environmental and social impacts.

2.11.3 Technology

The suitability of the available solar power technologies on the local conditions in Dubai has been analysed as part of the feasibility study by DEWA. The development of a centralised power plant using PV or concentrated solar power (CSP) technologies was concluded to be highly feasible based on the physical conditions of the investigated sites and the availability of solar energy in the region (i.e. global irradiation of 2,105 KWh/m^2a for PV and direct global irradiation of 2,061 kWh/m^2a for CSP). Considering the existing technology at the time of the study, the feasibility study showed that PV technology was more economically viable when compared to CSP technology.

The Phase V project will utilize bi-facial PV technology (on a single axis tracker), which is currently advanced technology for PV, and would be the first time that bi-facial technology is being utilised at the MBR solar park. Furthermore, another advantage of Bi-facial technology is the reduction in area size required for a 900MW plant compared to other technologies, which is apparent when comparing the overall Project land take to other Phases in the MBR Solar Park.

As renewable technology, the Project plays an important role in reducing the carbon intensity of current Dubai energy mix, minimizing and preventing long term and cumulative impacts to the environment (particularly climate-related impacts) both at the local, regional and global scale and create employment and training opportunities for UAE nationals in the field of solar and renewable energy. Other impacts such as localized pollution (air, noise, waste and wastewater) that might be more prevalent from conventional power plants tend to be avoided in operations.

This solar project alongside other renewable projects in Dubai will significantly reduce the dependence of the Emirate on foreign supplies of fossil fuels used in other conventional electrical power generation.

3 REGULATORY FRAMEWORK

3.1 National Requirements

3.1.1 International and Regional Treaties and Conventions

The Project is required to comply with the below applicable regional and international protocols and conventions to which the UAE is a signatory.

Table 3-1 Regional Protocols and Conventions

NAME OF REGIONAL PROTOCOL/ CONVENTION	SIGNED/ RATIFIED
Convention on Conservation of Wildlife and its Natural Habitats in the GCC Countries, 2001	2003

Table 3-2 International Protocols and Conventions

NAME OF INTERNATIONAL PROTOCOL/CONVENTION	SIGNED/ RATIFIED
Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC), 2015	2016
Memorandum of Understanding concerning the Conservation of Migratory Birds of Prey in Africa and Eurasia	2008
Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), 1997 - Non-Annex I Country	2005
Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2002
Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), 1997 - Non-Annex I Country	2005
United Nations Convention to Combat Desertification (UNCCD), 1994	1999
United Nations Convention on Biological Diversity, 1992	1999
United Nations Framework Convention on Climate Change (UNFCCC), 1992	1995
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 and amendments in 1995	1992
Montreal Protocol on Ozone Depleting Substances, 1987 and Montreal Amendments (London 1990, Copenhagen 1992, Vienna 1995, Montreal 1997, Beijing 1999)	1989
Vienna Convention for the Protection of the Ozone Layer, 1985	1989
Geneva Convention on Long-Range Transboundary Air Pollution, 1979	-
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973	1990
Convention Concerning the Protection of World Cultural and Natural Heritage, 1972	-

3.1.2 National Laws and Regulation

The UAE Federal Environmental Agency is the federal government body responsible for establishing environmental standards and pollution control in the United Arab Emirates. The federal law that establishes the framework for environmental protection in the UAE is Federal Law No. (24) of 1999 for the Protection and Development of the Environment. This law specifies the following key objectives:

- Protection and conservation of the quality and natural balance of the environment;
- Control of all forms of pollution and avoidance of any immediate or long-term harmful effects resulting from developments;
- Development of natural resources and conservation of biological diversity;
- Protection of the state of the environment from the harmful effects of activities undertaken outside the region or state; and
- Compliance with international and regional conventions regarding environmental protection, control of pollution and conservation of natural resources.

Federal Law No. (24) of 1999 contains several environmental principles and standards as part of its Executive Order which was issued by the Cabinet of Ministers in two Decrees. These have been considered relevant to the Project and they include:

- Ministerial Decree No. (12) of 2006 on the regulation concerning the Protection of Air from Pollution.
- Ministerial Decree No. (37) of 2001 including the following regulations:
  - The regulation concerning Environmental Impact Assessment of Projects;
  - The regulation concerning Handling of Hazardous Substances, Hazardous Wastes and Medical Wastes; and
  - The regulation concerning the Protection of the Marine Environment.

Other Federal Laws also applicable to this Project are:

- Federal Law No. (8) of 1980 concerning Regulation of Working Relations, as amended by Law No 12 of 1986. This is known as 'Labour Law' and is a comprehensive law that regulates all aspects of labour relations between employers and employees from employee entitlements to industrial safety, preventive measures, health and social care for workers and its Ministerial Orders or Decrees:
  - Ministerial Order No. (32) of 1982 Specifying Preventive Methods and Measures for Protecting Workers against Work Hazards;
  - Ministerial Decision No. (37/2) of 1982 on the Medical Care which the Employer is Obliged to Provide to his Workers;
  - Cabinet Resolution No. (13) of 2009 Approving the General Standards Manual of the Labour Collective Accommodation and Attached Services;
  - Ministerial Decree No. (764) of 2015 on Ministry approved Standard Employment Contracts;
  - Ministerial Decree No. (765) of 2015 on Terminating Employment; and

  - Ministerial Decree No. (766) of 2015 on Rules and Conditions for granting Work Permits.

- Federal Law No. 11 of 2002 for 'Regulation and Control the International Trade in Species of Wild Fauna & Flora'; and
- Federal Law No. 21 of 2005 concerning 'Traffic Law'.

3.2 Emirate Laws and Regulation

In the Emirate of Dubai, the entity responsible for developing environmental regulations in response to UAE Federal Law No. (24) of 1999 is the Dubai Municipality Environmental Planning and Studies Section (DM-EPSS). The local law that establishes the framework for environmental protection within the Emirate is the Local Order 61/1991 which addresses environmental issues relating to the disposal of wastewater, air pollution, noise pollution and protected areas for wildlife.

In addition to the Local Order 61 of 1991 on the Environment Protection Regulations in the Emirate of Dubai, the following environmental regulations, standards and guidelines are relevant to this Project and have been considered in the preparation of this Scoping report:

- Administrative Order No. 211 of 1991 on the Issue of the Executive Regulations for the Local Order No. 61 / 1991 on the Environment Protection Regulations in the Emirate of Dubai;
- Local Order No. 2 of 1998 on the Management of Protected areas in Dubai;
- Local Order No. 7 of 2002 on Management of Waste Disposal Sites in the Emirate of Dubai; as amended by Local Order No. 5 of 2003;
- Local Order 11 of 2003 Concerning Public Health and Community Safety in the Emirate of Dubai (Local Order 02 of 2004 Amending Local Order 11 0f 2003);
- Environmental Standards and Allowable Limits of Pollutants on Land, Water, and Air Environment (May 2003, Dubai Municipality);
- Local Order No. 15 of 2008 on the Protection of Groundwater in the Emirate of Dubai;
- Local Decree No. 22 of 2014 regarding the Establishment of Wildlife Sanctuaries in the Emirate of Dubai;
- All Applicable Codes of Practice, Information Bulletins and Circulars issued by Dubai Municipality Environment Protection and Safety Section (EPSS);
- Technical guidelines published by the DM EPSS, specifically:
  - Technical Guideline number 3 2010: Capture, rescue, translocation, release and restoration of wildlife in the Emirate of Dubai.
  - Technical Guideline number 4 on Separation Distance for utilities (STP, Power, Transmission Lines) and Commercial Livestock Farming from Sensitive Receptors (October 2014);
  - Technical Guideline number 7 on Policy on the Control of Ozone Depleting Substances (December 2014);

- Technical Guideline number 8 on Management of Recyclable Waste Material (December 2014);
- Technical Guideline number 9 on Requirements for Temporary and Permanent Concrete Batching Plants (December 2014);
- Technical Guideline number 9 Requirements for the Reduction of Construction/Demolition Noise (April 2011);
- Technical Guideline number 10 on Waste Minimisation (December 2014);
- Technical Guideline number 10 Guidelines for the Disposal and Re-Use of Used Chemical Containers, June 2011 and;
- Technical Guideline number 11 Requirements for Temporary and Permanent Concrete Batching Plants (April 2011).

- The Technical Guidelines published by the Dubai Municipality Environmental Control Section (DM-ECS) specifically:
  - Technical Guideline No. 1 on Disposal of Hazardous Wastes (January 2013);
  - Technical Guideline No. 2 on Disposal of Trade Wastewater (June 2011);
  - Technical Guideline No. 3 on Requirements for the Installation/Construction and Maintenance of Gravity Oil-Water Separator (June 2011);
  - Technical Guideline No. 4 on Waste Audit Reports (June 2011);
  - Technical Guideline No. 5 on Requirements for the Transport of Hazardous Wastes (June 2011);
  - Technical Guideline No. 6 on Bunding of Storage Tanks and Transfer Facilities (June 2011);
  - Technical Guideline No. 7 on Development of Emergency Response Procedures for Incidents Involving Dangerous Goods (June 2011);
  - Technical Guideline No. 10 on the Disposal and Re-use of Used Chemical Containers (June 2011); and
  - Technical Guideline No. 13 on Environmental Regulations for the Reuse of Treated Wastewater for Irrigation & Thermal Treated Sludge for Agricultural Purposes (June 2011).

3.3 Lender Requirements

ACWA Power is seeking an amount of project finance from financial institutions who either:

- Have their internal E&S standards and/or guidelines;
- Are signatories of collective agreements (such as the Equator Principles) for determining, assessing and managing environmental & social risks in projects; or
- Are required to implement the OECD Common Approaches (updated 2016) for finance relating to export credits.

At this stage, it is understood that ACWA Power is targeting finance from:

- Standard Chartered PLC; and
- Natixis.

Both Standard Chartered and Natixis are Equator Principles Financial Institutions (EPFIs), the requirements for whom are outlined under the Equator Principles.

3.3.1 Equator Principles

The Equator Principles (EP) is a risk assessment framework used by financial institutions to determine, assess and manage the environmental and social risk in projects financing. Currently, over 100 major financial institutions from around the world have adopted the EPs. These financial institutions operate in more than 100 countries worldwide.

The Equator Principles were updated in 2006 (EPII), 2013 (EPIII) and a further update EPIV Is due to become effective from July 2020. For the avoidance of doubt, Equator Principles IV have been used for this ESIA.

The EPs currently include provisions for the following:

- Principle 1: Review and Categorisation;
- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: Reporting and Transparency.

APPLICABLE STANDARDS

Equator Principle 3 establishes the minimum E&S standards to be adopted by the EPFIs as the IFC Performance Standards on Environmental and Social Sustainability (Performance Standards), the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) and/or the relevant host country laws, regulations and permits that pertain to environmental and social issues.

IFC Performance Standards

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), guiding 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 sustainably, including stakeholder engagement and disclosure obligations of the client concerning project-level activities.

The IFC Performance Standards (2012) are listed below:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labour and Working Conditions
  - Including the International Labour Organisation (ILO) Conventions
- Performance Standard 3: Resource Efficiency and Pollution Prevention
- Performance Standard 4: Community Health, Safety, and Security
- Performance Standard 5: Land Acquisition and Involuntary Resettlement
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

World Bank Group EHS Guidelines

The World Bank Group Environmental, Health and Safety (EHS) General Guidelines of April 2007 superseded the World Bank Handbook issue of 1998. The updated EHS Guidelines serve as a technical reference source to support the implementation of the IFC Performance Standards, particularly in those aspects related to PS 3: Resource Efficiency & Pollution Prevention, as well as certain aspects of Occupational and Community Health and Safety. The General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors.

No industry-specific EHS guidelines have been developed for solar power projects by the World Bank Group.

3.4 Applicable Environmental Standards

The environmental standards specified by UAE Federal laws, Dubai Municipality regulations and World Bank/IFC General EHS Guidelines that apply to the proposed Project are presented under the applicable sections for each assessed environmental parameter (from Section 5 onwards).

3.5 EIA/ESIA Requirements

3.5.1 Local Requirements

In the Emirate of Dubai, the entity responsible for developing environmental regulations in response to UAE Federal Law No. (24) of 1999 is the Dubai Municipality Environmental Planning and Studies Section (DM-EPSS).

In line with the existing DM Environmental Clearance for the 5,013MW PV & CSP Solar Park, there is no requirement for a specific EIA to be prepared and submitted for the Phase V 900MW PV project as the technology and project footprint both fall within the scope and stated conditions of the valid Environmental Clearance.

No further permitting or other clearance from DM is, therefore, being pursued in line with this ESIA at the planning phase of the Project.

3.5.2 Lender Requirements

ACWA Power is targeting finance from Standard Chartered PLC and Natixis, who are both signatories of the Equator Principles. According to Equator Principle 2, *'The EPFI will require the client to conduct an appropriate Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and scale of impacts of the proposed Project'*. This requires ESIA for Category A and where applicable Category B projects.

The level of assessment linked to the 'risks and scale' of the Project is primarily defined under the categorisation of the Project via Equator Principle 1. EPFIs are required to categorise a project proposed for financing based on the magnitude of its potential impacts and risks following the environmental and social screening criteria of the International Finance Corporation (IFC). These categories are:

- **Category A** - Projects with potentially 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, 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 project type and the surrounding environment of the proposed development, the DEWA Mohamed Bin Rashid Al Maktoum Solar Park – Phase V, 900MW Solar PV Project is expected to be classified as a Category B. Although the final determination of project categorisation will be made by each EPFI.

4 APPROACH TO ESIA

4.1 ESIA Terms of Reference

An ESIA Terms of Reference was previously submitted ACWA Power to be provided to prospective lenders. The ESIA ToR was prepared to identify receptors, local sensitivities and key environmental and social impacts related to the construction and operational phases of the project at an early stage, to ensure that the baseline surveys and assessment techniques for the subsequent ESIA address these issues specifically.

The ESIA ToR report included:

- Overview of existing Environmental Clearance of Solar PV & CSP projects within the wider MBR Solar Park from DM-EPSS.
- Preliminary identification and a brief description of the existing environmental conditions of the Project site and surroundings. Including identification of receptors and other sensitivities within the Project's area of influence;
- Identification of the ESIA methodology, structure and content of the ESIA report.
- The key features/technology and facilities of the proposed project facilities.
- Potential environmental issues, constraints and possible opportunities associated with the proposed project activities and facilities based on the existing information.
- ToR for conducting the ESIA, including an overview of proposed baseline surveys and assessment techniques.

It is noted that specific feedback on the ESIA ToR has not been received.

4.2 ESIA Methodology

4.2.1 Scope of Assessment

ASSESSMENT OF THE PROJECT, FACILITIES AND OPERATIONAL ACTIVITIES

The primary study area comprises the Project footprint, which includes, the proposed physical structures and equipment inside this area.

The ESIA assess the impacts that will result from the typical operations of the Project, whilst establishing provisions to manage the environmental and social effects of reasonably foreseeable emergencies.

ASSESSMENT OF ASSOCIATED FACILITIES

Associated facilities are those that are not funded as part of the Project and that would not have been constructed or expanded if the Project did not exist and without which the Project would not be viable. The associated facilities for assessment will include:

- Access Road

  - To be constructed by the EPC Contractor as part of the Project but will be operated by the Roads and Transport Authority (RTA).
- Electrical connection from the Project to the DEWA substation.
  - Responsibility of DEWA.

The assessment of these facilities will include their construction and operations.

CONSTRUCTION ACTIVITIES

Construction of the Project is expected to result in certain environmental and social impacts, as assessed herein.

Temporary Construction Facilities

Temporary construction facilities assessed in the ESIA include:

- Areas for Project offices and temporary facilities (on-site);
- Contractor compounds and laydown areas (on-site);
- Temporary construction equipment, utilities etc.
- Expected construction transportation routes.

Temporary Construction Worker Accommodation

The locations of such worker accommodation areas are not confirmed, but will not be on-site. This ESIA establishes management provisions for these areas to follow the IFC & EBRD Worker Accommodation: Processes and Standards (2009).

4.2.2 Consideration of Project Alternatives

Given that the Project will be located on pre-determined set land using CCGT technology to a specification established by the proponent, there are few reasonably feasible alternatives for assessment in the ESIA.

However, as a minimum the ESIA will include assessment of:

- No Project option; and
- Alternative technology (based on BAT analysis vs EU BREF). This will include:
  - Alternative cooling options (for water demand); and
  - Alternative power block equipment (for air emissions and noise).

4.2.3 Baseline Data Collection

Baseline data collection provides the basis for identifying key existing conditions and environmental and social sensitive receptors within the project site and its surrounding environment. This process enables the assessment of the potential impacts the proposed project might have on identified potential sensitive receptors during the construction and operational phases of the Project.

This ESIA has been informed by a review of relevant desktop information as well as a series of physical site surveys. Desktop information, which has been reviewed and has informed the environmental baseline include:

- Mohammed Bin Rashid Al Maktoum Solar Park Project, EIA Report for 1000 MW Solar PV Power Plant (Dome, October 2013);
- 3000MW Mohammed Bin Rashid Al Maktoum Solar Park EIA Report (Dome, November 2016);
- 5 Capitals primary site surveys conducted for the previous projects in the solar park and specifically for the Phase V Project location; and
- Available secondary web-based data
- Satellite mapping and aerial photographs of the Project site.

The physical surveys were undertaken at the Project site and its surrounding areas include:

SITE SURVEYS	PERIOD
Site Familiarisation	26th April 2020
Land use - Survey	26th April 2020
Air quality monitoring - survey	26th to 29th April 2020
Noise Monitoring - survey	27th to 28th April 2020
Soil Quality – sampling and analysis	26th April 2020
Habitat and Terrestrial Ecology - surveys	27th to 28th April 2020

The baseline surveys and results for the individual environmental parameters are described in the respective chapters herein, with any supporting raw data included to the Appendices.

4.2.4 Consultation and Stakeholder Engagement

It is noted that there are certain restrictions/difficulties in undertaking consultations in Dubai and the UAE more generally (particularly for public meetings). Under normal EIA (as required by DM-ED) there is no statutory requirement for consultation, although elements of it can be included for information gathering as necessary.

It is acknowledged that stakeholder engagement with affected communities is a key element of the Equator Principles, as well as ensuring applicable disclosure (of certain information) and the sharing of information with affected parties.

The EIA for the wider solar park has been through the regulatory process with DM-ED and there is general awareness amongst the population of the activities and facilities of the solar park, including specific phases, which are publicised in the media and used in marketing campaigns by various parties.

On the basis that there are no identified affected communities in the Project's area of influence, and in light of certain restrictions on consultations locally, there has not been specific stakeholder engagement or consultation during the ESIA process. Separate to the ESIA, a

standalone Stakeholder Engagement Plan (SEP) has however been prepared that identifies potentially affected and potentially interested stakeholders, as well as the methods for engaging with these parties. In addition, the SEP includes a grievance mechanism that has been tailored to the Project's context and allows for internal and third-party grievances to be raised in accordance with the requirements of IFC PS1 & 2 respectively.

4.2.5 Impact Significance Assessment Criteria

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[1] 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);
- 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);
- ***Human/Social*** 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 resource or receptor has been defined by using the criteria below in the table below.

[1] 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.

Table 4-1 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. • The receptor has already reached its carrying capacity, so any further impact is likely to lead to 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 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 the 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).

IDENTIFICATION AND EVALUATION OF ENVIRONMENTAL IMPACTS

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

- Direct Impacts - Potential impacts that may result from the construction, commissioning, and operations of the Project acting directly on an environmental or social receptor;
- Indirect Impacts – Potential impacts which are not a direct result of a Project activity, that may be realised later or at distances further removed from the project footprint, but are normally a result of a complex pathway;
- Cumulative Impacts – Changes to the environment that are caused by an action in combination with other past present and future actions.
- Beneficial Impacts – Those 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, jobs opportunities during the construction and/or occupation phases of a project);
- Adverse Impacts – Those impacts that are detrimental and have a negative influence on the environment, social structures, resources or other receptors;
- Secondary Impacts - Potential impacts that may result from the implementation of protection measures applied to mitigate potential direct impacts; and
- Event-Related Impacts - Potential unplanned or accidental impacts stemming from an unintentional event such as fire, explosion, oil spill, etc.

DEFINING IMPACT MAGNITUDE

The magnitude of the impact will be defined wherever possible in quantitative terms. The magnitude of an impact has several different components, for example:

- The extent of physical change;
- The level of change in an environmental condition;
- The permanence of impact and the reversibility of the impacted condition;
- Its spatial footprint;
- Its duration, its frequency; and
- Its likelihood of occurrence where the impact is not certain to occur.

Where necessary, the determination of impact magnitude may be assisted through the use of computer modelling. The criteria used for identifying the magnitude of impacts is provided within the table below.

Table 4-2 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 a 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 an 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

The significance of effects is a combination of the environmental value (or sensitivity) of a receptor or resource and the magnitude of the project impact value (change). In other words, it is this product of the impact acting on the receptor that produces an environmental effect. The table below provides the criterion used for determining the significance of environmental effects through consideration of the potential magnitude of impact and sensitivity of the associated receptor. Definitions of each significance categories are provided.

Table 4-3 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, the above significances are 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 4-4 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 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

Significance Category	Criteria
	enhancing the subsequent design of the project and consideration of mitigation or compensation measures.
Neutral	No effect or effect that is beneath the level of perception, within normal bounds of variation or the margin of forecasting error. No mitigation is required.

The significance of the effect is determined by comparison, wherever possible with the 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 effect are greater than the significance threshold, then this is termed a **Significant Effect**. Potential significant effects 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.

4.2.6 Mitigation & Management Measures

In addition to the mitigation incorporated as part of the Project design, the ESIA will consider the assessed impacts to develop further measures (where necessary) for applicable construction and the operational phase impacts.

4.2.7 Residual Impacts

The residual impacts section considers the overall significance of impacts following the implementation of the mitigation & management measures not already included in the design. The significance of such impacts will be re-evaluated based upon the same criteria used to determine the impact significance stated above.

4.2.8 Framework for Environmental and Social Management

ESIA Volume 3 includes a standalone framework to guide the Project parties in establishing structures for the management of Environmental and Social risks, impacts, opportunities and compliance associated with both the construction and operational phases of the Project.

The Framework outlines systematic structures and management programmes that will ultimately be prepared to comprise the respective construction and operational phase Environmental and Social Management Systems (ESMS).

The framework ensures alignment with applicable elements of the established ACWA Power corporate level Health, Safety Security and Environment (HSSE) Management System Framework, which is intended to ensure consistent and structured HSSE project management between ACWA Power projects.

It is intended that the EPC Contractor and O&M Company will prepare their respective CESMP and OESMPs as part of their wider ESMS'.

5 AIR QUALITY

This chapter describes and assesses the potential impacts that may occur as a result of the Project's construction and operational activities on air quality and identifies measures to be undertaken and implemented to mitigate and manage these impacts.

5.1 Standards and Regulatory Requirements

The sub-sections below detail the local, federal and lenders ambient air quality requirements that should not be exceeded as a result of the project activities (during both construction and operation).

5.1.1 UAE/Federal Requirements

Cabinet Decree (12) of 2006 is the Federal regulation concerning the Protection of Air from Pollution. Annexe (8) establishes the air pollutant limits in ambient air (Table 5-2) and Annex 7a establishes the maximum allowable limits of dust in working areas (Table 5-3).

Table 5-1 Federal Ambient Air Quality Standards

PARAMETER	MAXIMUM ALLOWABLE CONCENTRATION LIMITS (MG/M^3)	AVERAGING PERIOD
Sulphur Dioxide (SO2)	350	1 Hour
	150	24 Hours
	60	1 Year
Carbon Monoxide (CO)	30,000	1 Hour
	10,000	8 Hours
Nitrogen Dioxide (NO2)	400	1 Hour
	150	24 Hours
Ozone (O3)	200	1 Hour
	120	8 Hours
Total Suspended Particulates (TSP)	230	24 Hours
	90	1 Year
Particulate Matter less than ten Microns in diameter (PM10)	150	24 Hours
Lead (Pb)	1.0	1 Year
Source: Cabinet Decree No. (12) of 2006 concerning Protection of Air from Pollution, Annex (8)		

5.1.2 Local Requirements

The Environmental Standards and Allowable Limits of Pollutants on Land, Water and Air Environment (May 2003) as established by Dubai Municipality prescribe specific standards for ambient air quality conditions, as summarised below.

Table 5-2 Dubai Ambient Air Quality Standards

Parameter	Averaging Period	Maximum Allowable Concentration Ambient Air (mg/m3)
Sulphur Dioxide (SO_2)	1 Hour	350
	24 Hours	-
	1 Year	50
Carbon Monoxide (CO)	1 Hour	23,000
	8 Hours	-
Nitrogen Dioxide (NO_2)	1 Hour	290
	24 Hours	100
Ozone (O_3)	1 Hour	160
	8 Hours	-
Particulate Matter less than ten Microns in Diameter (PM_{10})	1 Hour	300
	24 Hours	150
Source: Environmental Standards and Allowable Limits of Pollutants on Land, Water and Air Environment (May 2003)		

5.1.3 Lender Requirements

Under the Equator Principles, the applicable ambient air quality requirements from the World Bank Group EHS General Guidelines (which reference the WHO ambient air quality standards) should be complied with, and are presented in the table below.

Table 5-3 WHO Ambient Air Quality Standards

Parameter	24 hour (mg/m3 unless otherwise specified)	Annual (mg/m3 unless otherwise specified)
PM_{10}	150 (Interim target 1)	70 (Interim target 1)
	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)	
Notes: - World Health Organization (WHO) Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile. - Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines. ***Source:*** World Bank General EHS Guidelines, 2007		

5.2 Observations and Baseline Conditions

5.2.1 Ambient Air Quality Influences due to Environment, Climate & Meteorology

The weather in Dubai includes extreme high daytime temperatures that can peak above 48 degrees Celsius (48˚C) in summer periods (typically in July and August), with abrupt temperature decreases at night (particularly in more central regions of the country) and minimum daily temperatures being generally no lower than 12˚C throughout the year. Precipitation occurs rarely in the UAE but is more frequent in the winter months between December and April. Average annual rainfall is generally below 100mm per year. It should also be noted that individual rainfall events could be quite high, for example, November in 2012 experienced 42.2mm during 24 hours. The prevailing winds in the UAE come from the northwest and south and tend to vary depending on the time of year. Winds can reach up to 80km/h during the winter Shamal season (December to March) but are more commonly around 40km/h. The average wind speed throughout the year is significantly lower, at around 20km/h.

Due to the environment and low rainfall, dust hazes occur reasonably frequently, especially in the summer months. Dust storms can also occur in the region and significantly impact upon ambient air quality, with high concentrations of suspended particulate matter.

5.2.2 Site-based Observations

The Project site is in a desert area approximately 40km from the coastline with a large amount of sand/dust in the air. Sandstorms are occasionally experienced, mainly between January to March and August to October. High ambient humidity, high air temperatures, high aerosol content and strong winds apply to the site.

The Project site is isolated and is away from primary pollution sources, with no known point sources of pollution locally. In addition, there are no identifiable diffuse emission sources, with very limited mobile sources (i.e. from any off-road vehicles in the area, or vehicles and equipment being used at the other solar park projects). The nearest significant emission source is approximately 5km off-site to the north-west where there are low flow vehicle movements from the road leading to the solar park. Any inputs of minor localised emissions (such as off-road vehicles or small generators) are expected to be indistinguishable from the ambient background concentrations at the Phase V site due to mixing.

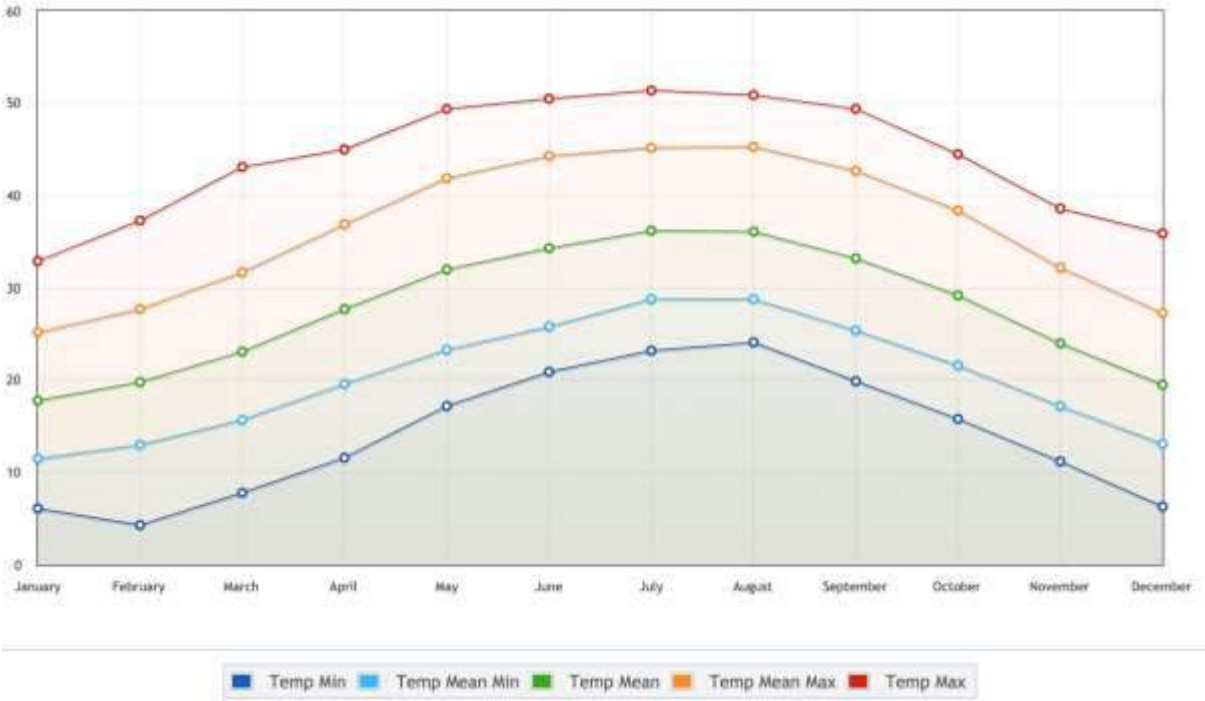
The nearest source for publicly available meteorological data is the Saih Al Salem meteorological station in proximity to the Project site. Table 5-4 presents monthly temperature, humidity and wind speed values, as well as monthly rainfall and solar radiation values, averaged for the period from 2003 to 2019 in Saih Al Salem as obtained from the National Centre of Meteorology and Seismology (NCMS).

Table 5-4 Average Monthly Temperature, Relative Humidity, Rainfall, Wind Speed and Solar Radiation in the Emirate of Dubai from 2003 to 2019

Month	Temperature (°C)			Relative Humidity (%)			Wind (km/h)			Rainfall (mm)	Mean Solar Radiation (wh/m²)
	Max	Mean	Min	Mean Max	Mean	Mean Min	Max	Mean	Mean Max		
January	31.9	17.8	6.1	90	66	33	10.8	78.5	25.2	4	3962.6
February	37.3	19.8	4.3	87	60	26	11.5	58.7	27.1	5.7	4748.4
March	43.1	23.1	7.8	83	52	20	12.2	59.4	29.1	15.1	5650.6
April	45.0	27.7	11.6	75	42	14	12.5	93.2	31.5	5.6	6235.9
May	49.4	32.0	17.2	70	37	10	13.1	63	32.3	0.2	6659.7
June	50.5	34.3	20.9	76	42	11	12.7	54.7	31.1	0.1	6952.7
July	51.4	36.2	23.2	73	42	15	12.5	55.1	30.3	0	6516.6
August	50.9	36.1	24.1	71	41	14	12.1	52.6	30.2	0	6236.3
September	49.4	33.2	19.9	83	49	14	11	60.1	28.9	0.1	6095.1
October	44.5	29.2	15.8	87	54	17	10.1	46.8	27.1	0.4	5395.6
November	38.6	24.0	11.2	86	59	26	9.7	70.2	24.3	3.7	4382.9
December	35.9	19.5	6.3	91	66	32	9.6	51.5	23.3	5	3869.2

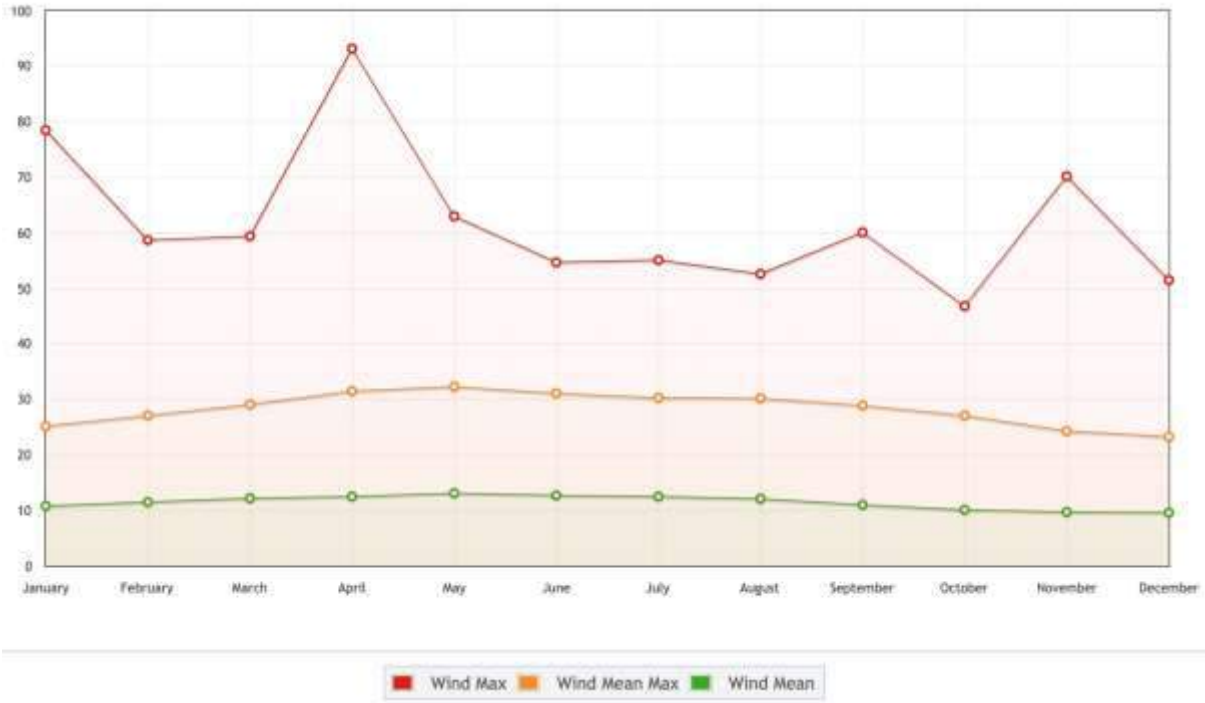
Note: Meteorological Data for Saih Al Salem Station (24° 49' 39" N, 55° 18' 43" E, Elevation 80m).
Source: Climate Yearly Report for Saih Al Salem Station, National Centre of Meteorology and Seismology (NCMS) for 2003 to 2017.

Figure 5-1 Temperature (°C) averages for the period for 2003 to 2019



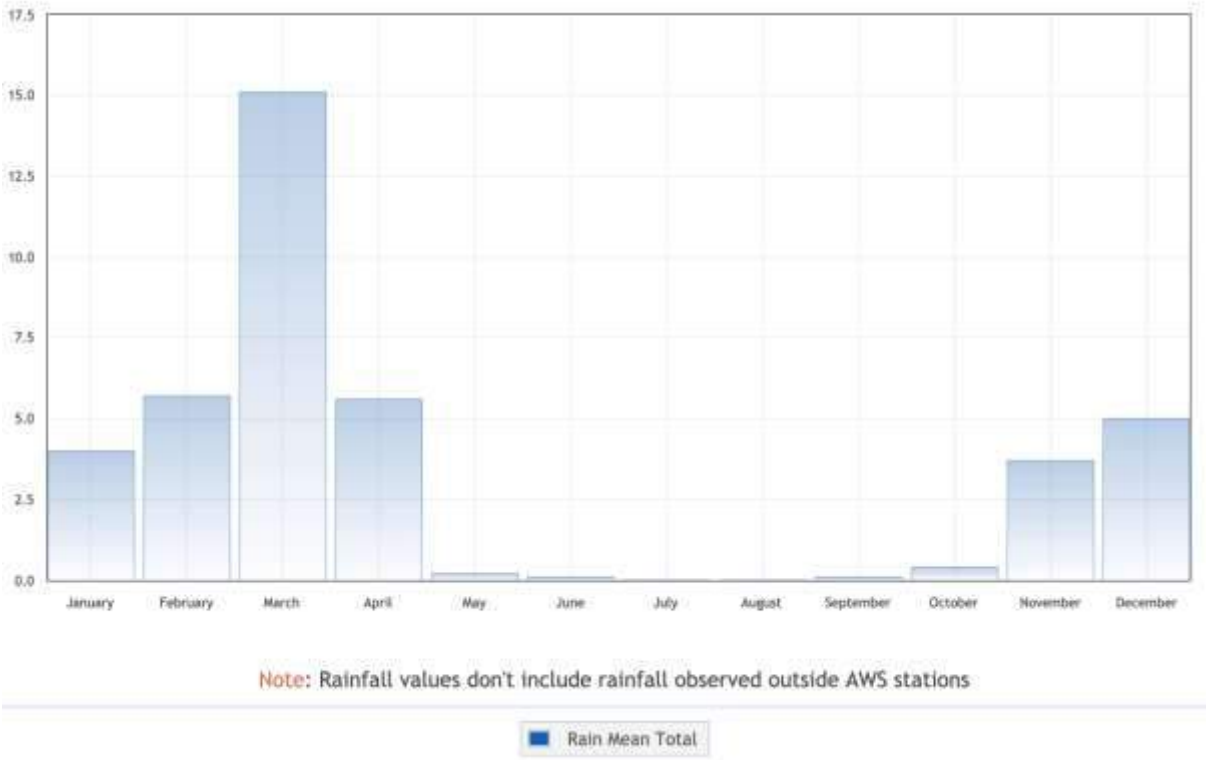
Source: http://www.ncm.ae/en/climate-reports-yearly.html?id=26 Accessed 1st April 2020

Figure 5-2 Wind Speed (km/h) averages for the period for 2003 to 2019



Source: http://www.ncm.ae/en/climate-reports-yearly.html?id=26 Accessed 1st April 2020

Figure 5-3 Average Monthly Mean of Total Rainfall (mm) for the period for 2003 to 2019



Source: http://www.ncm.ae/en/climate-reports-yearly.html?id=26 Accessed 1st April 2020

Figure 5-4 Solar Radiation Monthly Mean of Daily Totals (wh/m²) for the period for 2003 to 2019

Source: http://www.ncm.ae/en/climate-reports-yearly.html?id=26 Accessed 1st April 2020

AMBIENT AIR QUALITY MONITORING

To benchmark ambient air quality and to understand any potential pre-existing risks to the Project workforce, air monitoring was undertaken at three (3) locations within the Solar park between the 14th and 17th May 2020.

During the ambient air quality monitoring survey, a continuous high-volume mass sampler was used to monitor ambient concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3) and particulate matter ($PM_{2.5}$ and PM_{10}) at each monitoring location (note: calibration certificates are presented in Appendix D). The monitoring campaign was undertaken by 5 Capitals' sub-contracted laboratory, 'CORE Laboratories' (Dubai, UAE) ran for 72-hours at each monitoring location to allow the snapshot of air quality conditions to be benchmarked with hourly and 24-hourly standards, as well as observing any diurnal fluctuations in ambient air quality, or influences due to weather.

The locations of the air quality monitoring stations are presented in the figure below, with coordinates in the following table.

Figure 5-5 Locations of Ambient Air Quality Monitoring Stations

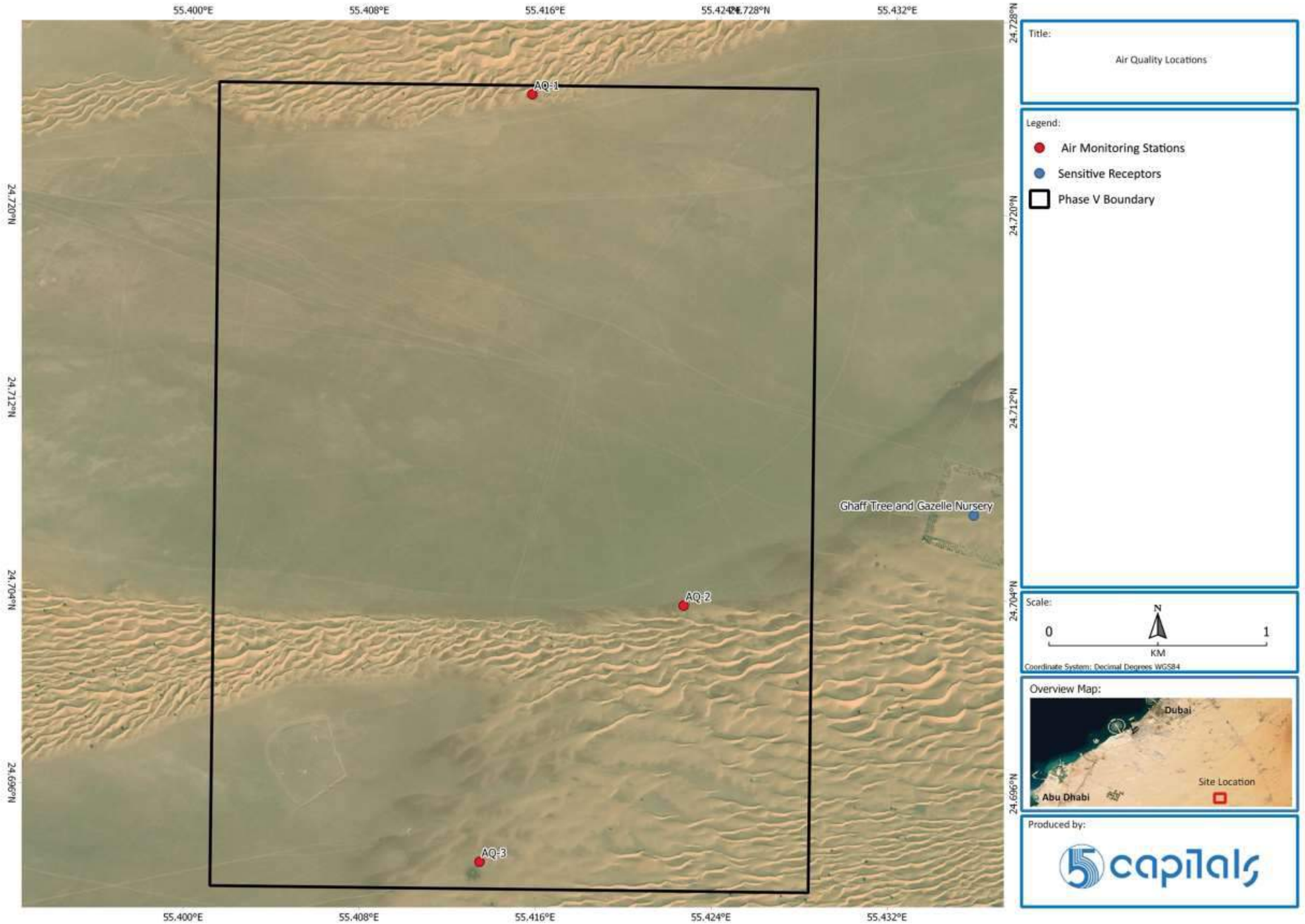
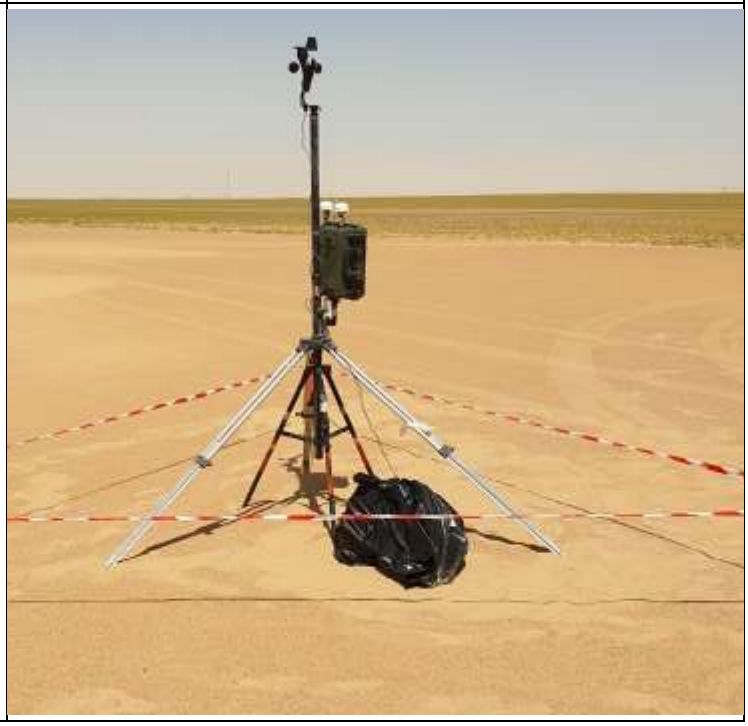


Table 5-5 Ambient Air Quality Monitoring Locations

ID	Co-ordinates DLTM		Photographs
	X Easting	Y Northing	
AQ1	508311.2942m	2735571.196m	
AQ2	509038.5514m	2733213.495m	

AQ3	508107.3684m	2732039.327m	

Based on the site observations (i.e. limited local air emission/pollution sources), the air quality monitoring campaign undertaken in April 2020 is considered representative of air quality at the Project area.

AMBIENT AIR QUALITY MONITORING RESULTS

The hourly average results for the ambient air quality monitoring survey are presented in Table 5-6, Table 5-7 and Table 5-8. The 24-hour average results are presented in Table 5-9 showing concentration of SO_2, NO_2, O_3, CO and Particulate Matter. These results have been compared with Local, Federal and Lender required ambient air quality standards.

The complete ambient air quality laboratory results are provided in Appendix F.

Table 5-6 Hourly Ambient Air Quality Result Obtained at AQ1

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R %	VV kph	DV °
Detection Limit	0.02	38	52	20	10	10	0.1	0.1	0.1	1
26th April 2020										
11:00	< 0.02	< 38	< 52	20	< 10	< 10	44.0	11.0	0.0	52
12:00	< 0.02	< 38	< 52	28	19	35	42.2	11.0	2.7	198
13:00	< 0.02	< 38	< 52	26	13	31	43.1	11.0	9.6	234
14:00	< 0.02	< 38	< 52	32	< 10	17	43.9	11.0	7.9	202
15:00	< 0.02	< 38	< 52	34	< 10	< 10	44.9	11.0	6.0	185
16:00	< 0.02	< 38	< 52	35	< 10	10	44.9	11.0	5.9	180
17:00	< 0.02	< 38	< 52	36	14	24	43.3	11.0	5.0	174
18:00	< 0.02	< 38	< 52	37	58	71	39.5	11.0	10.2	172
19:00	< 0.02	< 38	< 52	42	36	59	36.3	17.0	6.9	189
20:00	< 0.02	< 38	< 52	36	41	63	33.4	15.0	4.1	263
21:00	0.03	< 38	< 52	24	37	63	31.1	20.5	2.7	309
22:00	0.06	< 38	< 52	21	31	72	29.0	22.5	2.2	326
23:00	0.09	< 38	< 52	< 20	30	62	29.2	20.8	4.1	328
27th April 2020										DAY 1
00:00	0.12	< 38	< 52	< 20	33	70	29.0	21.3	2.2	325
1:00	0.22	< 38	< 52	< 20	33	53	29.3	31.5	11.6	142
2:00	0.33	< 38	< 52	< 20	23	64	27.9	36.8	5.9	231
3:00	0.26	< 38	< 52	< 20	28	55	27.2	40.0	3.3	239
4:00	0.36	< 38	< 52	< 20	58	88	25.7	41.3	2.2	317
5:00	0.25	44	< 52	< 20	75	91	24.6	36.5	4.7	332
6:00	0.12	< 38	< 52	< 20	37	86	24.8	32.8	4.5	329
7:00	0.14	< 38	< 52	< 20	27	92	27.1	29.0	3.0	253
8:00	0.10	< 38	< 52	23	21	26	31.1	21.8	4.4	58
9:00	0.05	< 38	< 52	25	< 10	12	39.1	12.3	6.3	21
10:00	< 0.02	< 38	< 52	26	< 10	< 10	45.4	11.0	11.4	41
11:00	< 0.02	< 38	< 52	24	< 10	< 10	48.7	11.0	12.3	52
12:00	< 0.02	< 38	< 52	25	< 10	13	51.2	11.0	13.5	90
13:00	< 0.02	< 38	< 52	24	< 10	< 10	52.8	11.0	13.3	120
14:00	< 0.02	< 38	< 52	29	68	104	50.3	11.0	13.2	207

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R %	VV kph	DV °
Detection Limit	**0.02**	**38**	**52**	**20**	**10**	**10**	**0.1**	**0.1**	**0.1**	**1**
15:00	< 0.02	< 38	< 52	38	23	61	43.9	16.0	6.4	235
16:00	< 0.02	< 38	< 52	46	39	69	41.7	19.0	0.0	239
17:00	< 0.02	< 38	< 52	37	26	35	41.3	16.0	8.2	250
18:00	< 0.02	< 38	< 52	31	15	27	39.5	16.0	9.1	254
19:00	< 0.02	< 38	< 52	31	46	69	36.0	20.0	7.7	246
20:00	0.06	< 38	< 52	28	39	64	33.5	21.3	2.6	280
21:00	0.15	48	< 52	28	41	72	32.7	22.8	3.1	230
22:00	0.21	< 38	< 52	23	37	79	31.4	26.8	2.9	227
23:00	0.20	38	< 52	< 20	85	126	29.0	30.3	1.7	301
28th April 2020										DAY 2
00:00	0.23	< 38	< 52	< 20	83	123	28.5	30.3	1.0	333
1:00	0.25	< 38	< 52	< 20	45	105	28.6	31.3	3.8	243
2:00	0.35	< 38	< 52	< 20	< 10	53	26.8	59.3	3.0	161
3:00	0.47	< 38	< 52	< 20	14	68	25.5	72.0	1.0	172
4:00	0.34	< 38	< 52	< 20	60	90	24.6	76.8	0.6	134
5:00	0.40	< 38	< 52	< 20	48	80	24.5	77.5	1.4	115
6:00	0.38	< 38	< 52	< 20	44	72	24.1	80.5	2.6	143
7:00	0.39	< 38	< 52	22	17	66	26.2	73.3	3.8	94
8:00	0.43	< 38	< 52	23	18	56	28.4	64.5	2.8	65
9:00	0.46	< 38	< 52	23	14	27	30.6	59.3	5.7	107
10:00	0.46	< 38	< 52	23	12	16	34.0	46.5	6.4	172
11:00	0.48	< 38	< 52	23	< 10	11	38.0	29.5	3.9	109
12:00	0.26	< 38	< 52	29	< 10	13	39.2	21.3	6.3	105
13:00	0.22	< 38	< 52	27	37	95	38.2	23.0	11	188
14:00	0.15	< 38	< 52	26	30	70	40.5	18.5	6.4	208
15:00	0.07	< 38	< 52	27	43	80	41.2	13.5	5.7	197
16:00	0.08	< 38	< 52	33	11	20	40.0	11.0	0.0	193
17:00	< 0.02	< 38	< 52	31	59	99	37.0	15.0	3.1	203
18:00	0.03	< 38	< 52	31	30	58	34.8	18.0	8.5	222
19:00	0.10	< 38	< 52	30	41	65	33.3	21.5	5.9	250
20:00	0.14	< 38	< 52	27	25	46	32.8	22.0	3.0	323
21:00	0.16	< 38	< 52	26	25	39	32.8	22.5	3.6	168
22:00	0.15	< 38	< 52	24	10	23	31.2	29.8	3.6	147
23:00	0.17	< 38	< 52	20	40	55	30.3	32.0	2.2	144
29th April 2020										DAY 3
00:00	0.24	< 38	< 52	< 20	27	49	30.5	31.5	5.0	129
1:00	0.31	< 38	< 52	21	22	33	29.5	36.0	4.0	161
2:00	0.29	< 38	< 52	< 20	21	58	28.1	39.8	1.4	237

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R %	VV kph	DV °
Detection Limit	**0.02**	**38**	**52**	**20**	**10**	**10**	**0.1**	**0.1**	**0.1**	**1**
3:00	0.31	< 38	< 52	< 20	63	150	27.6	39.5	2.1	327
4:00	0.20	< 38	< 52	< 20	53	184	26.3	41.0	1.3	252
5:00	0.21	< 38	< 52	< 20	30	58	25.7	41.3	0.8	324
6:00	0.21	< 38	< 52	< 20	10	32	26.6	39.5	1.9	337
7:00	0.20	< 38	< 52	< 20	< 10	15	26.8	38.8	0.5	332
8:00	0.22	< 38	< 52	< 20	13	22	32.4	26.8	3.1	331
9:00	0.14	< 38	< 52	23	24	48	34.9	22.0	1.2	334
10:00	0.12	< 38	< 52	25	28	56	31.3	23.0	0.8	342
DM-EPSS Standard	23	290	350	160	-	300	-	-	-	-
Federal Standards	30	400	350	200	-	-	-	-	-	-
WHO Standards	-	200	-	-	-	-	-	-	-	-

Table 5-7 Hourly Ambient Air Quality Result Obtained at AQ2

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R. %	VV kph	DV °
Detection Limit	**0.02**	**38**	**52**	**20**	**10**	**10**	**0.1**	**0.1**	**0.1**	**1**
26th April 2020										
12:00	< 0.02	< 38	< 52	< 20	< 10	26	41.9	11.0	0.0	18
13:00	< 0.02	< 38	< 52	26	< 10	12	42.2	11.0	10.2	36
14:00	< 0.02	< 38	< 52	30	< 10	< 10	42.8	11.0	12.0	25
15:00	< 0.02	< 38	< 52	30	< 10	< 10	43.5	11.0	8.8	33
16:00	< 0.02	< 38	< 52	28	< 10	< 10	43.5	11.0	8.4	22
17:00	< 0.02	< 38	< 52	27	20	70	42.8	11.0	6.4	184
18:00	< 0.02	< 38	< 52	28	29	80	39.2	11.0	15.7	7
19:00	< 0.02	< 38	< 52	26	19	59	36.2	17.0	12.6	13
20:00	0.09	< 38	< 52	< 20	< 10	52	33.3	12.0	3.9	79
21:00	0.28	< 38	< 52	< 20	10	49	31.2	20.3	6.3	143
22:00	0.33	< 38	< 52	< 20	< 10	45	29.6	21.0	7.6	152
23:00	0.27	< 38	< 52	< 20	< 10	39	28.8	21.0	9.6	148
27th April 2020										DAY 1
00:00	0.23	< 38	< 52	< 20	< 10	26	28.8	20.8	5.1	140

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R. %	VV kph	DV °
Detection Limit	0.02	38	52	20	10	10	0.1	0.1	0.1	1
1:00	0.33	< 38	< 52	< 20	13	46	30.1	30.3	15.5	255
2:00	0.40	< 38	< 52	< 20	< 10	35	28.5	34.0	5.9	67
3:00	0.47	< 38	< 52	< 20	11	53	28.6	32.3	4.1	141
4:00	0.42	< 38	< 52	< 20	25	79	27.3	32.0	6.6	155
5:00	0.32	< 38	< 52	< 20	14	50	27.8	24.3	12.8	158
6:00	0.24	< 38	< 52	< 20	13	44	28.1	24.0	13.3	158
7:00	0.25	< 38	< 52	< 20	11	37	28.3	23.5	4.4	180
8:00	0.20	< 38	< 52	25	< 10	33	32.1	16.0	5.4	229
9:00	0.21	< 38	< 52	22	< 10	< 10	36.6	11.8	5.9	203
10:00	0.23	< 38	< 52	27	< 10	< 10	39.9	11.0	11.1	228
11:00	0.16	< 38	< 52	23	< 10	< 10	41.5	11.0	13.2	243
12:00	0.10	< 38	< 52	38	< 10	< 10	46.4	11.0	15.7	288
13:00	< 0.02	< 38	< 52	31	< 10	< 10	52.2	11.0	18.1	317
14:00	0.04	< 38	< 52	37	< 10	66	51.2	11.0	21.5	107
15:00	< 0.02	< 38	< 52	< 20	< 10	56	45.8	15.0	20.4	42
16:00	< 0.02	< 38	< 52	22	46	159	41.2	18.5	0.0	49
17:00	0.03	< 38	< 52	23	18	65	40.9	15.8	5.0	60
18:00	0.14	< 38	< 52	23	< 10	11	38.9	18.5	10.8	66
19:00	0.08	< 38	< 52	< 20	16	39	35.3	20.0	10.5	53
20:00	0.21	< 38	< 52	20	< 10	42	32.2	23.3	2.5	99
21:00	0.25	< 38	< 52	< 20	< 10	35	30.1	27.0	0.7	58
22:00	0.32	< 38	< 52	< 20	< 10	53	29.3	28.8	1.9	22
23:00	0.30	< 38	< 52	< 20	13	103	29.0	30.0	3.6	132
28th April 2020										DAY 2
00:00	0.28	< 38	< 52	< 20	< 10	40	28.4	28.5	7.3	177
1:00	0.21	< 38	< 52	< 20	14	83	27.1	34.0	1.8	187
2:00	0.38	< 38	< 52	< 20	< 10	14	26.1	51.8	3.6	325
3:00	0.48	< 38	< 52	< 20	12	22	24.9	68.3	1.7	344
4:00	0.50	< 38	< 52	< 20	29	31	24.5	73.3	4.3	307
5:00	0.40	< 38	< 52	< 20	20	36	24.5	72.8	4.0	302

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R. %	VV kph	DV °
Detection Limit	0.02	38	52	20	10	10	0.1	0.1	0.1	1
6:00	0.44	< 38	< 52	< 20	19	44	23.9	75.0	5.2	321
7:00	0.33	< 38	< 52	< 20	14	41	26.0	69.0	3.8	270
8:00	0.48	< 38	< 52	< 20	16	53	30.6	55.8	2.4	244
9:00	0.41	< 38	< 52	< 20	< 10	< 10	33.0	45.8	6.2	299
10:00	0.50	< 38	< 52	< 20	< 10	< 10	37.0	36.8	10.4	271
11:00	0.32	< 38	< 52	23	< 10	< 10	40.1	24.5	4.8	144
12:00	< 0.02	< 38	< 52	30	< 10	< 10	41.2	19.8	8.2	297
13:00	< 0.02	< 38	< 52	32	13	108	40.3	20.5	18.5	21
14:00	< 0.02	< 38	< 52	30	< 10	53	41.3	16.3	10.5	24
15:00	< 0.02	< 38	< 52	27	< 10	45	41.8	12.8	9.3	178
16:00	< 0.02	< 38	< 52	30	10	252	40.2	11.0	0.0	21
17:00	< 0.02	< 38	< 52	26	35	155	37.1	15.3	3.0	34
18:00	< 0.02	< 38	< 52	22	24	86	34.5	18.0	16.3	37
19:00	< 0.02	< 38	< 52	25	11	49	32.9	20.3	8.4	67
20:00	0.04	< 38	< 52	< 20	< 10	42	32.2	22.5	5.7	144
21:00	0.07	< 38	< 52	< 20	< 10	30	32.2	22.3	4.8	163
22:00	0.09	< 38	< 52	< 20	< 10	16	30.8	24.0	3.5	248
23:00	0.13	< 38	< 52	< 20	< 10	40	29.7	29.8	2.2	314
29th April 2020										DAY 3
00:00	0.23	< 38	< 52	< 20	< 10	15	30.2	30.5	8.2	228
1:00	0.29	< 38	< 52	< 20	< 10	27	28.6	34.3	5.6	174
2:00	0.30	< 38	< 52	< 20	< 10	32	27.5	37.8	2.6	184
3:00	0.29	< 38	< 52	< 20	< 10	37	26.9	40.0	5.8	164
4:00	0.21	< 38	< 52	< 20	< 10	38	27.1	35.8	5.7	171
5:00	0.24	< 38	< 52	< 20	< 10	18	27.5	33.3	4.2	197
6:00	0.22	< 38	< 52	< 20	< 10	17	28.4	29.8	5.3	188
7:00	0.21	< 38	< 52	23	< 10	14	28.6	30.0	3.8	190
8:00	0.21	< 38	< 52	26	< 10	< 10	35.2	20.5	5.7	179
9:00	< 0.02	< 38	< 52	20	< 10	< 10	37.5	16.3	10.0	170
10:00	< 0.02	< 38	< 52	22	14	22	34.6	12.0	9.6	172
11:00	< 0.02	< 38	< 52	< 20	< 10	14	35.7	28.3	8.0	185
29th Apr 2020 00:00	0.23	< 38	< 52	< 20	< 10	15	30.2	30.5	8.2	228
DM-EPSS Standard	23	290	350	160	-	300	-	-	-	-

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R. %	VV kph	DV °
Detection Limit	**0.02**	**38**	**52**	**20**	**10**	**10**	**0.1**	**0.1**	**0.1**	**1**
Federal Standards	30	400	350	200	-	-	-	-	-	-
WHO Standards	-	200	-	-	-	-	-	-	-	-

Note: U.R – Relative Humidity, VV.- Wind Speed, DV- Wind direction. The DM and Federal Standards for carbon monoxide have been converted from µg/m³ to mg/m³ as the result for this parameter were provided in mg/m³.

Table 5-8 Hourly Ambient Air Quality Result Obtained at AQ3

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R. %	VV kph	DV °
Detection Limit	**0.02**	**38**	**52**	**20**	**10**	**10**	**0.1**	**0.1**	**0.1**	**1**
26th April 2020										
13:00	0.48	< 38	< 52	45	< 10	20	45.2	11.0	2.0	248
14:00	1.22	< 38	< 52	38	< 10	< 10	45.6	11.0	13.2	229
15:00	1.04	< 38	< 52	46	< 10	< 10	46.8	11.0	10.3	228
16:00	1.40	< 38	< 52	70	< 10	< 10	46.3	11.0	8.3	189
17:00	0.70	< 38	< 52	63	< 10	24	44.4	11.0	7.8	215
18:00	1.05	< 38	< 52	23	< 10	27	40.3	11.0	16.9	206
19:00	0.58	< 38	< 52	63	< 10	31	36.7	17.0	13.0	216
20:00	0.17	< 38	< 52	55	< 10	39	34.2	17.0	8.5	288
21:00	0.54	< 38	< 52	53	< 10	38	31.8	18.0	8.9	346
22:00	0.54	< 38	< 52	59	< 10	38	29.9	21.0	5.7	268
23:00	0.53	< 38	< 52	57	< 10	36	29.3	21.0	7.7	357
27th April 2020										DAY 1
00:00	0.44	< 38	< 52	51	< 10	27	29.6	20.8	7.7	277
1:00	0.33	< 38	< 52	24	< 10	100	30.7	28.3	18.0	187
2:00	0.46	< 38	< 52	23	< 10	26	29.1	32.3	9.4	265
3:00	0.60	< 38	< 52	48	< 10	38	29.1	33.0	6.1	142
4:00	0.58	< 38	< 52	52	< 10	70	27.6	33.3	5.8	170
5:00	0.63	< 38	< 52	60	< 10	62	27.3	28.0	5.3	2
6:00	0.47	< 38	< 52	40	< 10	40	27.6	23.5	4.1	2
7:00	0.44	< 38	< 52	50	< 10	29	28.8	21.5	5.9	216

Hourly Average Results	CO mg/m³	NO_2 µg/m³	SO_2 µg/m³	O_3 µg/m³	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	Temp °C	U.R. %	VV kph	DV °
Detection Limit	0.02	38	52	20	10	10	0.1	0.1	0.1	1
8:00	0.51	< 38	< 52	45	< 10	18	33.0	15.3	8.7	64
9:00	0.79	< 38	< 52	52	< 10	13	38.7	12.3	10.6	57
10:00	1.99	< 38	< 52	< 20	< 10	< 10	41.2	11.0	15.3	69
11:00	2.74	< 38	< 52	20	< 10	10	43.3	11.0	16.3	76
12:00	2.08	< 38	< 52	28	< 10	< 10	44.1	11.0	18.7	120
13:00	2.78	< 38	< 52	20	< 10	< 10	45.0	11.0	19.0	155
14:00	1.51	< 38	< 52	21	< 10	54	43.5	12.8	20.7	223
15:00	0.12	< 38	< 52	< 20	< 10	42	43.6	12.0	19.7	244
16:00	< 0.02	< 38	< 52	24	< 10	23	42.9	13.5	0.0	251
17:00	0.04	52	< 52	21	< 10	18	41.7	16.0	0.0	275
18:00	0.60	70	< 52	20	< 10	30	39.8	18.3	12.2	275
19:00	0.31	80	< 52	22	< 10	53	36.2	20.0	11.8	264
20:00	0.41	62	< 52	26	< 10	41	33.5	21.0	7.1	289
21:00	0.41	47	< 52	47	< 10	45	31.7	25.5	4.3	243
22:00	0.45	45	< 52	56	< 10	43	30.7	27.3	5.6	226
23:00	0.48	42	< 52	52	< 10	106	29.5	29.5	5.0	232
28th April 2020										DAY 2
00:00	0.47	< 38	< 52	49	10	72	28.3	30.3	4.5	174
1:00	0.36	< 38	< 52	35	< 10	30	27.9	32.0	3.6	258
2:00	0.46	< 38	< 52	44	< 10	49	26.6	44.3	3.1	152
3:00	0.51	< 38	< 52	35	< 10	36	25.4	69.5	2.1	165
4:00	0.55	< 38	< 52	28	< 10	30	24.6	78.5	2.8	132
5:00	0.48	< 38	< 52	31	< 10	33	24.7	76.0	4.3	118
6:00	0.52	< 38	< 52	34	< 10	36	24.3	78.5	4.3	148
7:00	0.44	< 38	< 52	27	< 10	34	26.4	71.8	5.2	90
8:00	0.69	< 38	< 52	30	< 10	40	31.1	58.3	3.5	57
9:00	1.10	< 38	< 52	74	< 10	35	34.4	47.3	7.5	127
10:00	0.88	< 38	< 52	74	< 10	21	37.2	38.8	10.9	190
11:00	1.22	< 38	< 52	54	< 10	23	41.0	25.5	4.8	227
12:00	1.50	< 38	< 52	76	< 10	< 10	41.8	17.5	9.2	123

Hourly Average Results	CO mg/m³	NO_2 µg/m3	SO_2 µg/m3	O_3 µg/m3	$PM_{2.5}$ µg/m3	PM_{10} µg/m3	Temp °C	U.R. %	VV kph	DV °
Detection Limit	**0.02**	**38**	**52**	**20**	**10**	**10**	**0.1**	**0.1**	**0.1**	**1**
13:00	0.69	< 38	< 52	67	< 10	50	40.4	21.0	19.3	204
14:00	0.85	< 38	< 52	58	< 10	48	41.1	17.5	11.6	209
15:00	0.71	< 38	< 52	46	10	53	42.0	13.0	10.5	201
16:00	0.55	< 38	< 52	56	10	47	40.4	11.0	0.0	204
17:00	0.21	< 38	< 52	36	< 10	41	37.9	11.0	0.0	216
18:00	0.29	< 38	< 52	45	< 10	35	35.4	15.5	16.4	223
19:00	0.45	< 38	< 52	47	< 10	30	33.5	21.0	9.9	251
20:00	0.58	< 38	< 52	43	< 10	34	32.8	21.5	7.2	324
21:00	0.53	< 38	< 52	39	< 10	32	32.1	25.0	4.5	251
22:00	0.52	< 38	< 52	37	< 10	25	31.6	25.5	3.8	164
23:00	0.39	< 38	< 52	29	< 10	27	30.2	29.8	3.4	132
29th April 2020										DAY 3
00:00	0.59	< 38	< 52	24	< 10	25	31.1	31.3	8.9	142
1:00	0.57	< 38	< 52	31	< 10	19	29.3	35.5	6.9	178
2:00	0.52	< 38	< 52	25	< 10	33	28.1	38.3	3.8	189
3:00	0.50	< 38	< 52	24	< 10	39	26.9	41.5	6.5	337
4:00	0.41	< 38	< 52	21	< 10	38	26.4	40.3	3.8	345
5:00	0.46	< 38	< 52	22	< 10	24	26.8	37.0	3.0	94
6:00	0.47	< 38	< 52	23	< 10	15	27.6	32.0	3.5	179
7:00	0.47	< 38	< 52	24	< 10	11	28.2	31.0	1.3	92
8:00	0.52	< 38	< 52	28	< 10	13	35.7	22.8	4.0	266
9:00	0.88	< 38	< 52	51	< 10	< 10	40.7	15.5	7.5	177
10:00	0.24	< 38	< 52	38	< 10	18	35.4	15.0	7.1	169
11:00	0.17	< 38	< 52	28	14	28	33.5	11.0	6.7	171
12:00	0.40	< 38	< 52	30	10	15	32.0	25.0	6.0	150
DM-EPSS Standard	23	290	350	160	-	300	-	-	-	-
Federal Standards	30	400	350	200	-	-	-	-	-	-
WHO Standards	-	200	-	-	-	-	-	-	-	-

Note: U.R – Relative Humidity, VV.- Wind Speed, DV- Wind direction. Also, the DM-EPSS and Federal Standards of carbon monoxide has been converted from µg/m3 to mg/m3 as the result for this parameter was provided in mg/m3

Table 5-9 24 Hours Ambient Air Quality Result Obtained at All Monitoring Stations

24 HOURS AVERAGE RESULTS	CO MG/M³	NO_2 µG/M³	SO_2 µG/M³	O_3 µG/M³	$PM_{2.5}$ µG/M³	PM_{10} µG/M³	TEMP °C	U.R. %	VV. KPH
DETECTION LIMIT	0.02	38	52	20	10	10	0.1	0.1	0.1
AQ1 Day 1	0.09	< 38	< 52	23	26	48	34.8	20.7	5.3
AQ1 Day 2	0.20	< 38	< 52	24	32	62	34.7	37.6	5.2
AQ1 Day 3	0.19	< 38	< 52	22	27	57	32.9	27.4	3.6
AVERAGE	0.16	< 38	< 52	23	28.3	55.7	34.1	28.6	4.7
AQ2 Day 1	0.18	< 38	< 52	< 20	< 10	36	34.7	18.3	8.5
AQ2 Day 2	0.26	< 38	< 52	< 20	11	42	34.4	34.4	6.9
AQ2 Day 3	0.11	< 38	< 52	< 20	< 10	47	33.4	24.2	6.9
AVERAGE	0.18	< 38	< 52	<20	11.0	41.7	34.2	25.6	7.4
AQ3 Day 1	0.85	< 38	< 52	45	< 10	29	35.8	18.4	9.8
AQ3 Day 2	0.68	< 38	< 52	38	< 10	38	33.8	36.4	7.1
AQ3 Day 3	0.50	< 38	< 52	36	< 10	29	33.3	24.5	6.5
AVERAGE	0.68	< 38	<52	39.7	<10	32.0	34.3	26.4	7.8
DM-EPSS Standard	-	100	-	-	-	150	-	-	-
Federal Standards	-	150	150	-	-	150	-	-	-
WHO Standards	-	-	20	-	25	50	-	-	-

Note: U.R – Relative Humidity, VV.- Wind Speed, DV- Wind direction. Also, the DM-EPSS and Federal Standards of carbon monoxide has been converted from µg/m3 to mg/m3 as the result for this parameter was provided in mg/m3

Carbon monoxide (CO)

The hourly monitoring result obtained for carbon monoxide was low at the three monitoring locations. The average concentration over 3 days across all locations was 0.34mg/m³ The highest concentration of this pollutant was 2.78mg/m³ which occurred at Air Quality Monitoring Station 3 (AQ3) on Day 1 at 13:00hours.

When compared with the applicable hourly ambient CO standard established by DM-EPSS and Federal Environmental Agency, the concentrations of this air pollutant within and outside the Project site were well below the required limits of 23mg/m³ and 30mg/m³ respectively.

Hourly average results, as well as 24 hours average result, could not be compared with WHO guidelines, as this WHO for carbon monoxide has not established standard values.

Nitrogen dioxide (NO_2)

The hourly monitoring result obtained for the three monitoring locations were very low and as expected given the isolation of the site; with the concentration below the detection limit for the majority of the time. There were only a few detectable concentrations with the highest

hourly NO_2 concentration recorded at AQ3 on the 27th April at 19:00 with a concentration of 80µg/m^3. This is well below the DM-EPSS, Federal and WHO/IFC standards of 290µg/m^3, 400µg/m^3 and 200µg/m^3 respectively.

Sulphur dioxide (SO_2)

The hourly monitoring result obtained indicate that the concentration of sulphur dioxide was below the detection limit of 52µg/m^3 at all monitoring locations for the entire monitoring period. This is well below the DM and Federal hourly Standard of 350 µg/m^3 and is as expected given the isolation of the site away from liquid (and solid) fuel combustion sources.

The average 24-hours concentration of SO_2 was also below the detection limit of 52µg/m^3 at all monitoring locations. This is well below the Federal 24-hourly ambient SO_2 concentration of 150µg/m^3. The result obtained, therefore, indicates that the concentration of this pollutant in the air is well within the required limits for both 1-hourly and 24-hourly standards.

Ozone (O_3)

As expected, due to typical diurnal fluctuations (due to sunlight)), the hourly monitoring concentrations of ozone at all monitoring locations were identified to be lower during the evenings and early mornings, with an increase during daytime reaching peak concentration in the late afternoon. This is common due to the suns irradiance being strongest at these times increasing the chemical reactions between the oxides of nitrogen (NOx) and Volatile Organic Compounds (VOC) in the atmosphere; ultimately resulting in the production of ground-level Ozone.

The highest concentration of Ozone was 76µg/m^3 which occurred at noon on the 28th April 2020 at AQ3. Comparison of the results with DM and Federal Ozone standards of 160µg/m^3 and 200µg/m^3 respectively showed that the concentration of Ozone was well below the 1-hour averaging period standard throughout the entire monitoring period.

The highest 24-hour average result was 45µg/m^3 which occurred at AQ3 on Day 1.

Particulate Matter (PM_{10} and $PM_{2.5}$)

The hourly monitoring concentration of PM10 at all monitoring locations throughout the entire monitoring period was below DM-EPSS hourly standard of 300µg/m^3 with the highest concentration being 252µg/m^3 at AQ2 on the 28th of April 2020.

However, when compared with WHO 24-hour standards of 50µg/m3, the concentration of this particulate matter exceeded the limit at AQ1 on Day 1 and Day 2 with the highest 24-hour concentration measured at 62 µg/m3. It must be noted that the WHO guidelines were established taking into consideration developed and undeveloped areas but in non-desert environments, and as such may not be suitable for comparison of ambient air condition in the Phase V project's environment; of which the concentrations of particulates are not linked to anthropogenic emission sources. The average 24-hour monitoring results were found to be well

below the maximum allowable limits of DM-EPSS and Federal standards of 150µg/m^3. The result obtained for PM2.5 cannot be compared as standard values have not been designated by DM-EPSS, Federal and WHO standards.

5.3 Receptors

Observations from site visits and satellite imagery have identified few receptors in proximity to the Project boundary that may be vulnerable to changes in ambient air quality. No receptors remain within the project boundary. External to the Phase V project site, but within the Solar Park, a camel farm and a gazelle & Ghaf tree nursery were identified east of the Project boundary, approximately 700m and 2.8km respectively.

Field C of the Phase III 800MW project is approximately 450m north of the Project boundary while the solar innovation centre under construction is approximately 6.4km to the north-west project boundary. The Phase I 13MW & Phase II 200MW operational projects are north-west of project boundary, approximately 6.3km and 4km respectively. Phase IV Parabolic Trough 2 is approximately 1.3km towards the north-east of the project site.

According to the UK's IAQM Guidance on the Assessment of Dust from Demolition and Construction, when there is a 'human receptor' within 350m of the construction works or 50m of a route used by construction vehicles on public roads (up to 500m from the site entrance), and where there is an 'ecological receptor' within 50m of the boundary of the site, or within 50m of a route used by construction vehicles on public roads (up to 500m from the site entrance) there may be potential for impacts relating to dust dispersion and settlement.

Hence, changes in ambient air quality in regards to construction works are therefore not considered applicable to the solar park facilities over 350m from the Project boundary (all phases). Other isolated agricultural, commercial and residential receptors are at greater proximity and are considered to be outside of the Project's area of influence for air quality.

However, changes in ambient air quality concerning construction vehicles on public roads are considered applicable to all solar park facilities within 50m of the access road to the Project site as well as the Al Qudra cycling track next to the route proposed to be used by construction vehicles for temporary access to the Project site. The Al Marmoom Desert Conservation Area, which covers the entire Solar Park is also susceptible to air quality impacts.

Figure 5-6 Air Quality Receptors

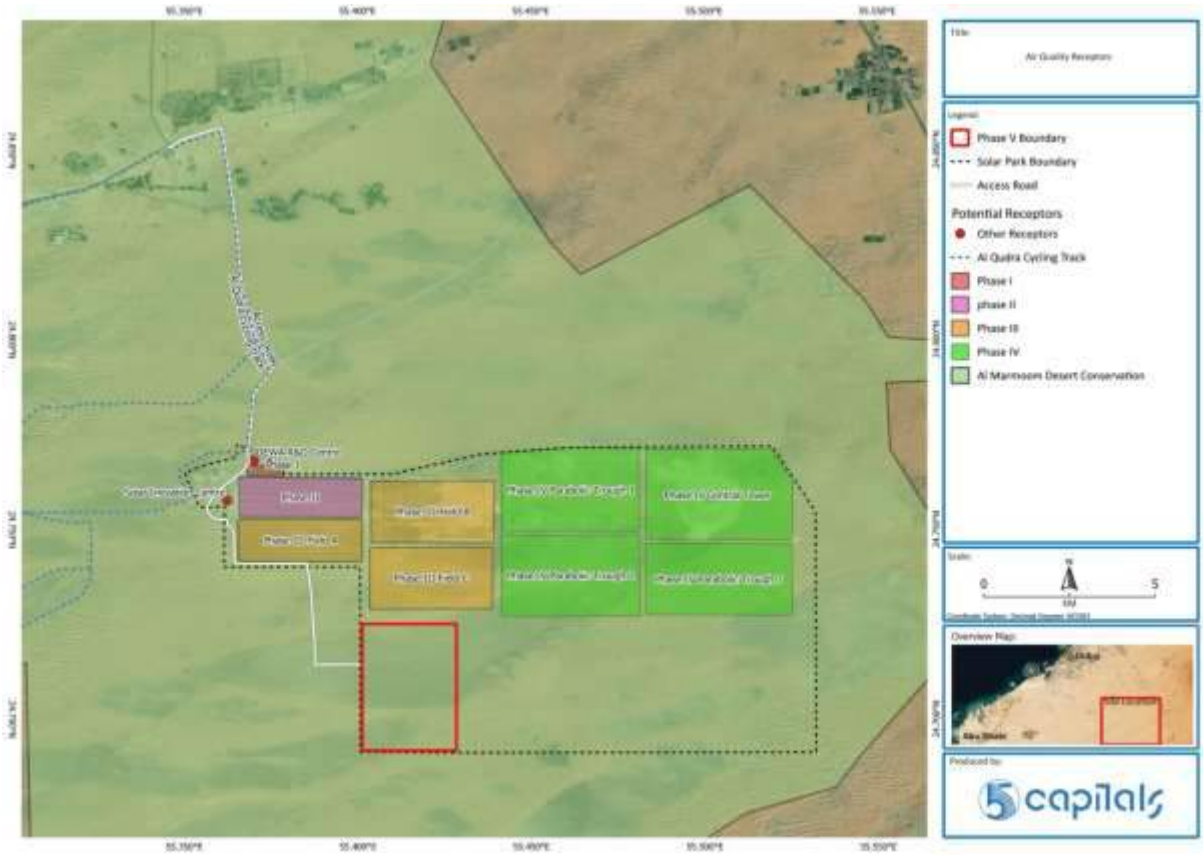


Table 5-10 Air Quality – Receptor Sensitivity

Receptor	Sensitivity	Justification
Other Solar Park Facilities	**Low**	As industrial receptors, these receptors are not very sensitive to impacts from construction or operational activities.
Al Qudra cycling track	**Medium**	As a recreational receptor, the cycling track is potentially sensitive to impacts from construction or operational activities.
Al Marmoom Desert Conservation Area	**High**	As a conservation area that protects and preserve several vulnerable species such as the Arabian Oryx, this receptor is therefore considered to be highly sensitive to air quality impacts from construction or operational activities.

5.4 Potential Impacts

5.4.1 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 dunes areas and earthworks) and by the exhaust gases of construction vehicles, equipment and temporary power generators. The typical air emissions resulting from these activities include nitrogen oxides, sulphur dioxide, carbon monoxide, carbon dioxide, VOCs, particulates and BTEX.

The principle sources of particulate and gaseous emissions during construction will be:

- Excavations and earthworks, such as groundbreaking, cutting, filling and levelling;
- Truck movements on unpaved, or compacted surfaces;
- Particulate matter dispersion from uncovered truckloads;
- Vehicle and Construction equipment emissions (e.g. NO_x, SO_x and CO, CO_2, VOCs, particulates and BTEX) and particulates from vehicles, generators and other mechanical equipment; and
- Stored VOCs and other volatile hazardous materials.

DUST EMISSIONS

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

- Excavations and earthworks, such as groundbreaking, cutting, filling and levelling;
- Truck 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.

In the instance of this Project, earth movements will be noticeable given the size and relatively large dune areas to be levelled across the Project site, dust impacts from construction works may be discernible to other solar park facilities within proximity of the Project boundary; particularly the Field C of the Phase III 800MW PV Plant adjacent to the Project boundary. However, the magnitude of dust impacts from construction works will depend on the wind speed and wind direction which have been observed to predominantly come from the north-west. However in the mornings, the wind tends to come from the desert (Southerly), therefore dust impacts may be more noticeable in the mornings.

Dust Emissions & Particulate Emissions from Movement of Vehicles

Except for vehicle movements on unpaved surfaces (i.e. along any unauthorized tracks), 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 the dispersion of the material. Such impacts have the potential to degrade local air quality in the immediate area of such movements.

As per 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' or 'ecological' receptors are located within 50m of the route used for construction vehicles, up to 500m from the project site entrance. In the instance of the Project, only certain Solar Park Facilities and the Al Qudra Cycling track are located within 50m from the access road. Hence there is the potential for impacts relating to dust generation or particulate emissions as a result of an increase in traffic on this route.

In addition to this, the Project is located within the Al Marmoom Conservation Area and as such there are potential impacts to areas surrounding the Project boundary. Impacts related to dust are however unlikely to be of a high magnitude, given the similarity of the dust material to the surface of the surrounding land. Possible impacts of dust settling on vegetation are also possible and would be most notable in areas immediately adjacent to the site. Such impacts are not, however, unprecedented and would resemble similar conditions that flora (and also fauna) experience during dusty atmospheric periods (which are common in the region).

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 limited to those listed in Section 4.6.2 under the subheading 'Vehicles, Equipment & Heavy Machinery Requirements'. The volume of gaseous emissions from this equipment will depend on the numbers deployed on-site and the hours of operation and as such have not been calculated.

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 from background concentrations at receptors. Given the low (mostly below detectable) concentrations of NO_2 and SO_2 from the baseline surveys, any impacts are expected to be well within applicable ambient air quality standards. This is expected to be the case for cumulative emissions from construction plant.

EMISSION OF VOLATILE ORGANIC COMPOUNDS (VOCS)

A low 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, any potential impacts will be limited to the immediate surrounding area. Impacts may occur to areas immediately outside of the site, where inappropriate storage or use of substances is near the construction site boundaries.

Odours

Temporary on-site sanitation and toilet facilities will be provided for staff and construction workers. There is the potential of odour in the immediate surrounding areas from inappropriate containment and coverage associated with wastewater holding/septic tanks. These potential impacts are likely to be temporary and limited to the immediate surrounding area (i.e. <50m from source). Therefore, impacts at other receptors are not expected.

Table 5-11 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	Other Solar Park Facilities (Adjacent Phase III and IV Solar Fields)	Low	Negligible to 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). • All dust-generating activities should cease during periods of high wind conditions (15km/h) • Material stockpiles higher than 5 meters will be avoided where possible, with a dust control method (e.g. dust suppression sprays or cover) being utilized on any piles during periods where the wind speeds exceed 15km/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 after use and if necessary stored 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 to avoid dust dispersion during storage or use.	Negligible
		Al Marmoom Desert Conservation Area	High	Minor to Moderate		Negligible to Minor

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impact
					• Vehicle speeds on all site roads will be restricted to 20km/h. • Where paved routes are not available, vehicle routes will be demarcated, and appropriate signage displayed around the site. • Wetting down of any unpaved on-site roads to reduce dust generation. • The provision of a wheel-washing facility or high-pressure hose to ensure all vehicles leaving the site are in a satisfactory state of cleanliness. Dry wheel cleaning is recommended unless adequately treated water can be reused.	
Gaseous Emissions – From exhaust of vehicles	Negligible Negative	Other Solar Park Facilities (Solar Park facilities within 50m of internal access route)	Low	Negligible to Minor	• Limit unnecessary usage of vehicles, plant and equipment – No unnecessary idling. • Deliveries of equipment/plant to the site will be efficiently managed to reduce the number of trips. • Appropriate quality of fuel used – Fuel to International standards to be sourced through a licensed local company • Exhaust fumes and particulates emitted from trucks and vehicles will be minimised by ensuring the use of good condition vehicles (e.g. compliant to national mobile emission/vehicle emission requirements). • Lorries and trucks engines will be turned off while waiting on-site to minimize gaseous emissions. Air-	Negligible
		Al Qudra Cycling Track	Medium	Minor		Negligible
		Al Marmoom Desert Conservation Area	High	Minor to moderate		Negligible to Minor

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impact
					conditioned or heated shelters should be provided for drivers in designated waiting, loading and unloading areas. • Emissions from vehicles, plant and equipment should be free from significant black smoke.	
Emission of VOCs and other hazardous volatiles	Negligible Negative	Other Solar Park Facilities (Adjacent Phase III Solar Fields)	Low	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 • Volatile fuels and chemicals 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	Negligible to Minor
Odour from onsite sanitary facilities	Minor Negative	n/a	n/a	n/a	• Adequate and sufficient sanitary facilities for site workers must be provided. • Effective cleaning and maintenance of toilets to be undertaken to avoid odour dispersion. • All septic tanks must be sealed and fully functioning. • Septic tanks must be operated and maintained according to manufacturer recommendations.	n/a

5.4.2 Operational Phase

The proposed project is associated with the generation of renewable energy, hence there are no permanent fuel combustion requirements or any other associated air emissions directly from the PV Plants. 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 emergencies only (which feasibly may not occur). Also, there is a diesel-powered pump as part of the fire suppression systems for use in emergencies only. 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.

Table 5-12 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	Negligible Negative	Other Solar Park Facilities (Solar Park facilities within 50m of internal access route)	Low	Negligible or Minor	• Appropriate quality of fuel used – Fuel to International standards to be sourced through a licensed local company. • Limit unnecessary usage of vehicles – No unnecessary idling • Emissions from vehicles should be free from significant black smoke - remedial measures shall be taken if this is observed. • Ensure emissions comply with Maximum allowable limits for air pollutants emitted by mobile vehicles established by law. • Implement a regular maintenance program of vehicles, and keep documentary evidence.	Negligible

5.5 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 Monitoring Plan'.

Table 5-13 Air Quality Monitoring Requirements

MONITORING	PARAMETER	FREQUENCY & DURATION	LOCATION	RESPONSIBILITY
Construction				
Dust Generation	Dust	Visual observation for dust emissions to be undertaken daily. To be monitored quantitatively if generation is excessive or complaints are received.	Access Road, Construction site and laydown areas Dispersion to external receptors from point of generation.	EPC Contractor
Emissions from engines	Vehicle Emissions	Before the use of equipment on-site and annually.	All non-road vehicles and engines	EPC Contractor
Odour	Sanitary Facilities	Daily – as part of maintenance and inspection checks	All sanitary facilities available within the laydown areas and work fields	EPC Contractor
Operation				
Emissions from engines	Vehicle emissions	Planned annual inspection and regular maintenance of project vehicles	All road and non-road vehicles and engines	O&M Company

6 NOISE AND VIBRATION

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

6.1 Standards and Regulatory Requirements

6.1.1 Federal & Local Requirements

NOISE EMISSION LIMITS

Noise emission limits for plant, equipment and vehicles are not established in Cabinet Decree No. 12 of 2006 concerning Protection of Air from Pollution or the Dubai Municipality Environmental Standards and Allowable Limits of Pollutants on Land, Water and Air Environment (May 2003).

The Local Order No. 61 of 1991 on the Environment Protection Regulations of the Emirate of Dubai establishes in Chapter VII 'Noise Control Regulations' that *"it shall be the duty of the occupier of any premises or persons operating mechanical devices or drivers of public or private vehicles, houses owners or supervisors of worshipping place, to adopt the best practicable means of ensuring that the emission of noise from those premises does not exceed a reasonable level"*. Reasonable noise levels are set as:

- A maximum of 55dB(A) from 7am to 8pm (daytime); and
- A maximum of 45 dB(A) from 8 pm to 7 am (night time).

AMBIENT NOISE STANDARDS

Cabinet Decree No. 12 of 2006 concerning Protection of Air from Pollution establishes the Federal Ambient Noise Standards, which apply to the Project both during construction and occupation phases. Per FEA noise limits the following table (Table6-1) summarises the environmental noise requirements regarding community noise, which is broken down by the sensitivity of the community and the time of day.

Table 6-1 Federal Maximum Allowable Limits for Noise Level in Different Areas

Receptor Areas	Allowable Limits of Noise (dbA)	
	Daytime (7 am -8 pm)	Evening (8 pm-7 am)
Residential Areas with Light Traffic	40-50	30-40
Residential Areas in Downtown	45-55	35-45
Residential Areas with some workshops & Commercial or near highways	50-60	40-50
Commercial areas & Downtown	55-65	45-55
Industrial Areas (Heavy Industry)	60-70	50-60

Source: Cabinet Decree No. 12 of 2006 concerning Protection of Air from Pollution, Annex (6)
Note: Dubai Municipality Technical Guidelines refer to Federal Ambient Noise Limits

Where existing baseline noise conditions already exceed the above thresholds, allowable increases from existing baseline are defined as presented in the following table.

Table 6-2 Allowable incremental increase, in noisy areas

Measured Average Noise Level (dbA)	Allowable Increase (dbA)
50 to 60	5
61 to 65	4
66 to 70	3
71 to 75	2
76 to 80	1
81 and higher	0

Source: Technical Guideline No.09 Requirements for the Reduction of Construction and Demolition Noise (April 2011)

With regards to noise levels and exposure in workplaces, the Administrative Order No. 211/91 Article 42 lists the maximum number of hours of exposure for a worker.

Table 6-3 Maximum hours of exposure to noise, for workers

Sound Level in Decibels	Max Hours of Exposure per Employee per Day
87<db<90	8
90<db<92	6
92<db<95	4
95<db<97	3
97<db<100	2
100<db<102	1.5
102<db<105	1
105<db<110	0.5
110<db<115	0.25
115<db	0

6.1.2 Lender Requirements

Applicable ambient noise standards as established by the WHO and as referenced from the World Bank EHS Guidelines (2007) are presented in Table 6-4. Noise impacts should not exceed the levels presented above, or result in a maximum increase in background levels of 3dB(A) at the nearest sensitive receptor location off-site.

Table 6-4 WHO Ambient Noise Level Guidelines

Receptor	One Hour LAeq (dBA)	
	Daytime (7am-10pm)	Night (10pm-7am)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

6.2 Observations and Baseline Conditions

6.2.1 Noise

The Project site is extremely isolated and is located away from permanent anthropogenic noise-generating activities, processes or functions. During the various site visits undertaken as part of this ESIA, the only observations made concerning anthropogenic influences upon noise have resulted from the distant temporary site preparatory activities at the Phase IV project and occasional vehicle movements on tracks close to the site area. It is noted that noise from the Phase IV site was only discernible during calm periods and was at a very low magnitude (only just discernible). Noises propagating from the construction works is largely attenuated due to distance, but also to an extent by the intervening topography, comprising dunes and limited vegetation cover.

Noise from other sources is variable in duration and dependant on the types of works/activities/external influences coinciding with the visits. For example, this included influences of occasional overhead aircraft. No sustained/steady noises have been observed at any other time.

NOISE MONITORING SURVEY METHODOLOGY

The choice of seven monitoring locations was as a result of the large size of the Phase V Project area but also factored in the lack of sensitive noise receptors and noise sources within or around the project footprint.

During the noise monitoring surveys, ambient noise levels were monitored continuously for a period of 15-minutes at each location during daytime while taking note of any noise influences from the surrounding environment (ref. Table 6-6 for site observations). Noise surveys were intended to be conducted during calm weather conditions to obtain representative noise baseline data at each location, without the influence of wind. This was typically not possible on the days of the surveys, which included wind speeds of up to and above 5m/s. However, data has been recorded from evening periods under calm conditions. Given the lack of noise influences locally and potential for variations in noise sources from day to night or weekday to weekend, this monitoring method is considered to be representative.

The monitoring was undertaken using a Cirrus CR: 811C sound level meter (S/N D20575FD), which has been calibrated at an accredited laboratory in Abu Dhabi, UAE. The calibration certificate is provided in Appendix E. The noise meter was arranged at a height of 1.5m above the ground level and at least 3.5m away from any abstraction or reflecting surfaces. The noise meter was calibrated in the field before each measurement cycle.

The noise monitoring locations are illustrated below in Figure 6.1 and Table 6.5

Figure 6-1 Noise Monitoring Survey Locations Phase V

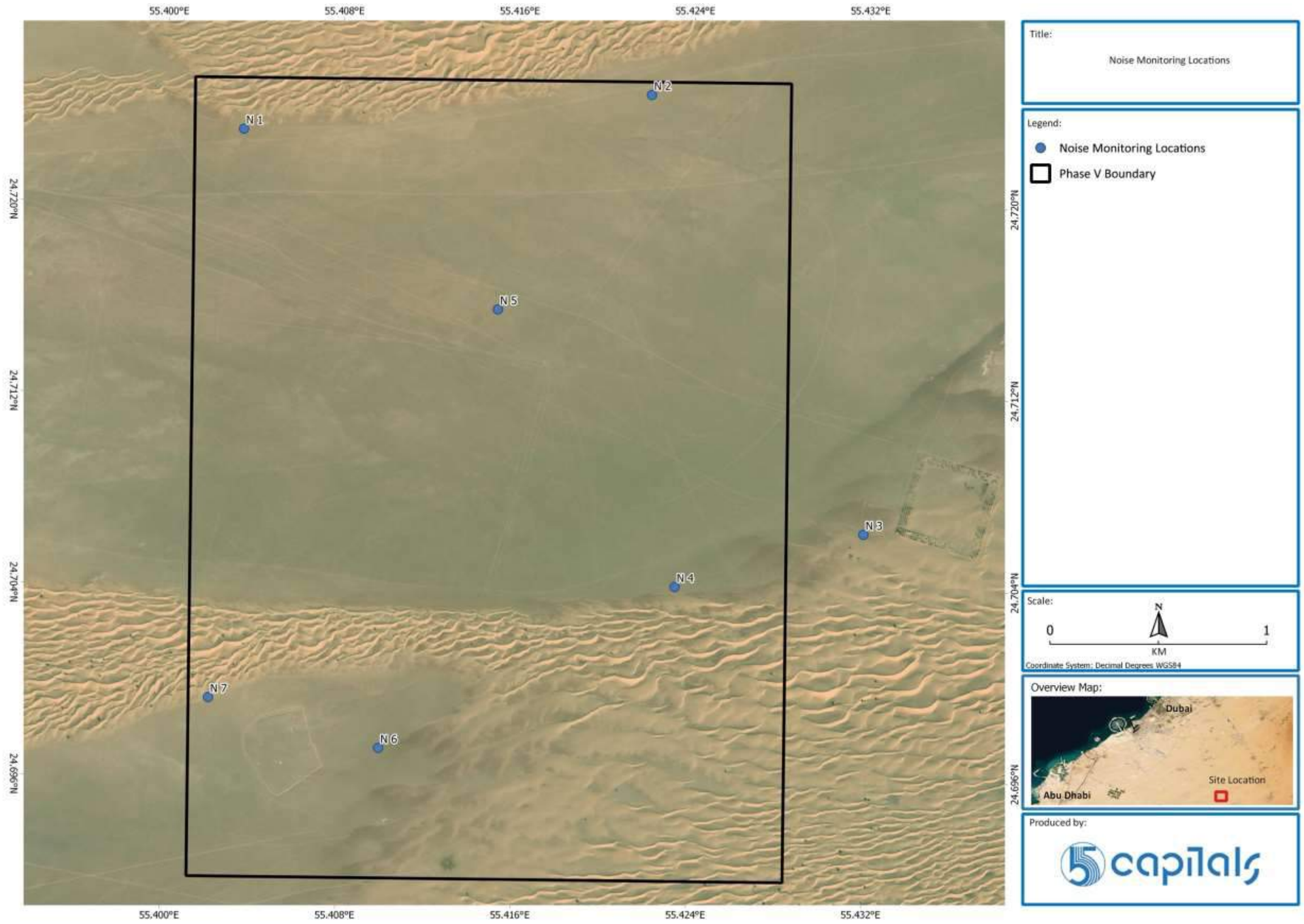


Table 6-5 Noise Monitoring Locations Phase V

ID	Location	DLTM Coordinates		Photo
		Northing	Easting	
N-1	North-west corner of the project area	2735375.79m	507095.08m	
N-2	North-east corner of the project area	2735554.77m	508976.62m	
N-3	East from the project site, next to Ghaf and Gazelle Nursery	2733532.27m	509976.97m	
N-4	West from Gazelle nursery, inside project boundary	2733280.33m	509108.33m	

ID	Location	DLTM Coordinates		Photo
		Northing	Easting	
N-5	Centre of Project Area, on a gravel plain	2734554.43m	508277.20m	
N-6	The southern side of the project area, on a gravel area.	2732519.41m	507748.65m	
N-7	The southern side of the project area, on a dunal area.	2732745.07m	506960.32m	

Noise Monitoring Survey Results

Please note that during the noise monitoring survey conducted in 2020, the Phase IV 700MW Project was still undergoing construction and was exerting a minor influence on some of the noise monitoring locations as detailed in the site observations column of the table below.

Table 6-6 Noise Monitoring Results

ID	Date & Time	Wind Speed and Direction	Measured Noise Level			Site Observations
			Leq	Lmax	Lpeak	
N-1	27/04/2020 08:43- 08:58	3m/s from the South	50.2dB	72.2dB	91.7dB	Noise from construction activities was barely discernible at this location. The primary source of noise at this location was from wind and insects with the occasional overhead plane passing.
N-2	27/04/2020 09:32- 09:47	5m/s from the South / Southeast	47.8 dB	60.2 dB	100.2 dB	Noise from construction activities was barely discernible at this location. The primary source of noise at this location was from wind and insects.
N-3	27/04/2020 10:06- 10:21	3m/s from the South / Southeast	50.2 dB	62.4 dB	105.6 dB	Noise from construction activities was barely discernible at this location. The primary source of noise at this location was from wind.
N-4	27/04/2020 10:30- 10:45	4m/s from the East / Southeast	50.0 dB	66.6 dB	98.8 dB	Noise from construction activities was barely discernible at this location. The primary source of noise at this location was from wind and insects with the one passing vehicle.
N-5	28/04/2020 17:58 – 18:13	5m/s from the West	53.1 dB	68.6 dB	102.1 dB	The primary source of noise at this location was from wind and an occasional passing vehicle.
N-6	28/04/2020 18:28 – 18:43	2m/s from the West	35.6 dB	58.6 dB	89.1 dB	Very distant noise from construction at Phase IV. No other discernible noise influences.
N-7	28/04/2020 18:52 – 19:07	Calm/ 1m/s from the west	25.1 dB	47.7 dB	84.0 dB	Very distant noise from construction at Phase IV. No other discernible noise influences.

Leq Results

The noise level (Leq) monitored at noise monitoring location N-1 to N-5 ranged between 47.8dB(A) – 53.1dB(A) which is relatively high for an isolated, open field area with limited noise influences. As is stated above, there was some influence from wind during these periods and distant construction noise from the phase IV project.

However, noise monitoring at N-6 and N-7 took place in the early evening during relatively calm periods. This resulted in a calm and quiet environment as expected in an isolated, open

desert area with a Leq reading of 25.1dB at monitoring location N-7. This is extremely quiet and is consistent with the lack of any nearby noise influences.

When compared with daytime Federal industrial ambient noise level and WHO industrial, commercial ambient noise level, the results obtained for representative sites N-6 and N-7 were well below the Federal and WHO noise limits of 60 – 70dB(A) and 70dB(A) respectively. Likewise, when compared with daytime Federal Residential and Commercial Areas as well as WHO Residential, Institutional, Educational allowable noise limits of 40 - 65dB(A) and 55dB(A) respectively, the noise monitoring results obtained were within the required noise limit.

See Appendix G for the complete report.

6.2.2 Vibration

The project is located at a great distance from any permanent facilities/works/processes that may potentially generate vibration. During all site visits undertaken to date, no noticeable vibrations were encountered.

6.3 Receptors

Findings from the baseline site visits and observations of satellite imagery identified few receptors within proximity of the project boundaries that may be vulnerable to changes in noise.

The entirety of the Project site is surrounded by the Al Marmoom Conservation Reserve as such, any potential noise impacts to fauna species are assessed in Section 7 'Terrestrial Ecology'.

External to the Phase V project footprint, but within the Solar Park, Ghaf tree nursery and 2 camel farms are located approximately 700m, 2km and 5km east of the Project boundary respectively. Field A and B of the Phase III 800MW project is approximately 2.4km northwest and north respectively of the Project boundary while Field C is directly north of the Project boundary. The Phase IV 700MW parabolic trough 2 is approximately 1.3km from project boundary, while parabolic trough 1 and 3 are 4.3km and 5.6km away.

Only those receptors within 2km of the Project works are expected to be affected by an increase in noise levels as a result of construction activities. This may extend slightly further during calm periods.

In regards to vehicle noise assessment, the solar park facilities along the internal access road of the Solar Park and the Al Qudra cycling track alongside the route to be used by vehicles during construction are included in the vehicle noise assessment.

Figure 6-2 Noise Receptors

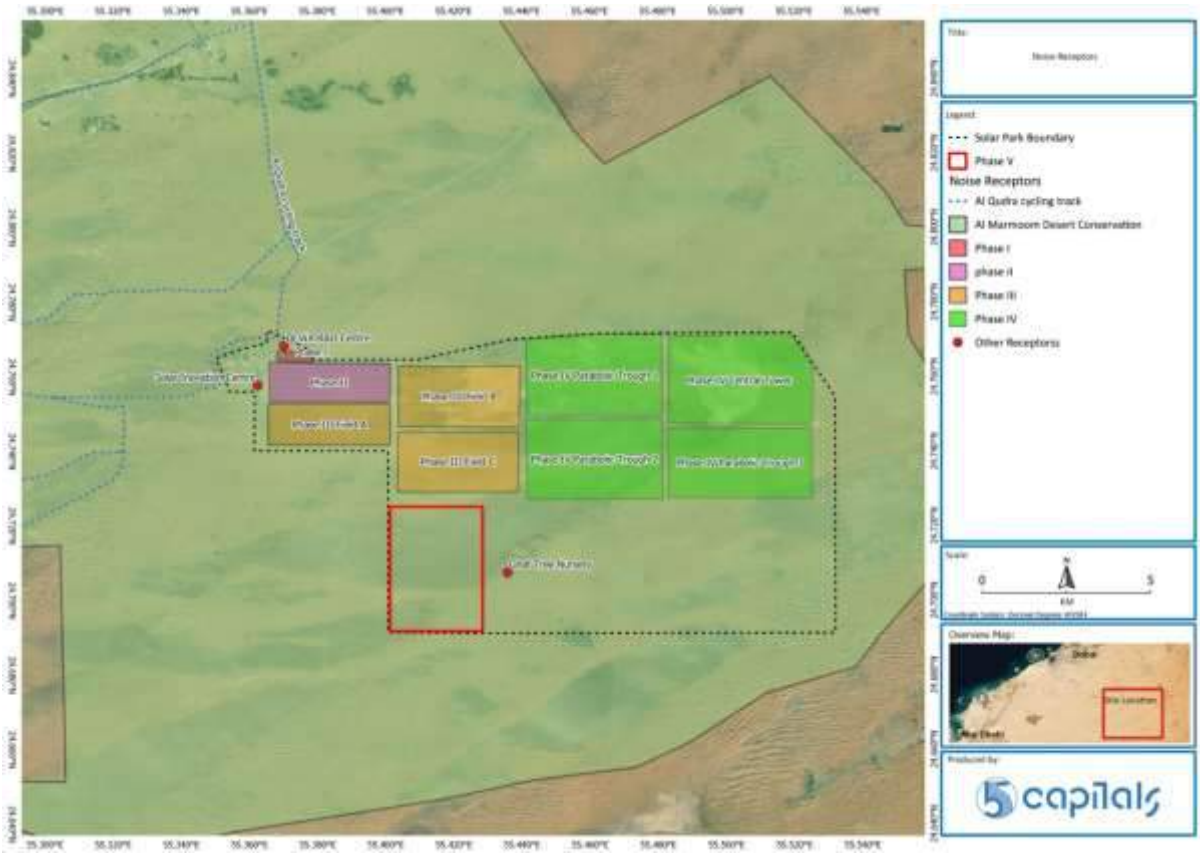


Table 6-7 Noise – Receptor Sensitivity

RECEPTOR	SENSITIVITY	JUSTIFICATION
Other Solar Park Facilities	**Low**	As industrial receptors, these receptors are not very sensitive to noise impacts.
Al Qudra cycling track	**Medium**	As a Recreational / Comercial receptor, the cycling track is slightly sensitive to impacts from construction or operational activities.
Al Marmoom Desert Conservation Area	**High**	As a conservation area that protects and preserve several vulnerable species such as the Arabian Oryx, this receptor is Highly sensitive to noise impacts from construction or operational activities.
Ghaf tree nursery	**Medium**	Although Ghaf trees are protected under UAE Federal Law they are not sensitive to noise impacts. There is however a small area for nursery staff in this location, who may be there on an occasional basis. As such, there is potential that these workers may be sensitive to changes in noise.

6.4 Potential Impacts

6.4.1 Construction Phase

CONSTRUCTION SITE NOISE

Construction activities are expected to result in the temporary and short-term generation of noise dependant on the type of works being undertaken. Noise will be generated and will propagate to the surrounding environment via a range of construction activities that are likely to include:

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

The initial earthworks stage and site preparation are likely to generate the highest magnitude noise and vibration. This is primarily due to a large number of heavy vehicle movements and the nature of the excavation and grading activities, which will include direct interactions with the site soils for items such as compaction and ground improvement. Where the hard ground is encountered, this may require heavy equipment for the groundbreaking.

Concerning the expected construction plant/machinery to be used at the site, noise data for the anticipated plant/equipment to be used at the site has been obtained from 'British Standards: Code of practice for noise and vibration on construction and open sites' and are listed below.

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)	73
	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 telescopic Crane (100t)	71
	C.4.48	Tower crane (22t)	76
Stationary	C.4, 84	Diesel generator	74

Construction Activities	BS 5228-1:2009 Reference	Equipment	SPL dB (A)*
	C.5, 21	Vibratory Roller (12t)	80
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 for nearby receptors. In the assumed worst case with the noisiest of the above-listed equipment operating at full power at the same time and the same location, the combined cumulative noise level would be approximately 90dB(A), as perceived at 10m distance from the noise source.

Considering the 800MW Phase III Field C and Phase IV parabolic Trough 2 are located in relative proximity to the project site, a 400m-separation distance is assumed and a basic assessment of distance propagation and ground absorbance based on the worst-case premise of project construction noise assessed above would reduce construction noise levels to well below 70dB(A) at a distance of ≥400m from the project works. It is considered highly unlikely that the worst-case conditions stated above would materialise with a point of reception less than 400m, to result in noise levels above 70dB(A) at the adjacent Phase III and IV fields. Therefore impacts due to noise at the other Solar Park facilities, are not expected to exceed 70dB(A). As industrial receptors, the noise levels can be considered to be acceptable based on WHO receptor noise standards.

Concerning ecology, noise associated with construction is likely to trigger a flight response from local fauna particularly mammal species such as the Arabian Oryx and Gazelles that have been observed to freely roam the site and surrounding areas. Considering the nearest receptor is the Ghaf tree nursery (where some gazelles have been observed to congregate) is 700m east of the project boundary, impacts due to noise on ecology are further assessed in Section 7 'Terrestrial Ecology'.

VEHICULAR NOISE

The addition of temporary construction vehicles on access roads and within the site at this isolated location will likely result in temporary increases in traffic which will consequently result in an increase to noise levels at receptors near access roads. Impacts due to vehicular noise will vary due to the phasing of works and the timing of vehicular movements, which affect both vehicles flow and the percentage of heavy vehicles.

Temporary noise impacts relating to construction vehicles and particularly heavy vehicles have the potential to occur along routes where a noticeable increase in traffic flows will occur due to increased dedicated movement of vehicles to the project site. Typical construction impacts are expected to include a localised increase of noise in the immediate corridor of access roads.

The major transport routes to the site have been identified as the Majlis Road that links the Solar Park to the D63 road. The Majlis road provides dedicated access to the Solar Park facilities only and there are no through roads that adjoin to it. Presently, traffic flows on this 2-way single carriageway road are low and expected to range between 150 – 200 vehicles per hour at peak periods (2-way flow); based on observations during site visits. Vehicles currently comprise those for the Solar Park facilities under construction as well as operational movements for Phases I, II, III & IV. Due to the existing low traffic flows on this road, impacts due to additional vehicular transportation during Project construction are expected to be noticeable.

As a worst-case, it is considered possible that construction vehicles for the Phase V project may double existing vehicle flows along the proposed access roads. Under guidance from the UK's 'Calculation of Road Traffic Noise' (CRTN) (UK - Department of Transport, Welsh Office, 1988), a doubling of vehicle flows (assuming the same makeup of HGV's and same traffic velocity) will only result in a 3dB(A) increase of noise at a receptor. Following the UK Highways Agency Design Manual for Roads and Bridges (DMRB), a road traffic increase of 3dB(A) of noise is of moderate magnitude.

VIBRATION

Certain construction processes, particularly those involved with site preparation and civil works to improve soil bearing capacity, soil structure and ground stabilization such as e.g. clearing, breaking, piling, vibratory rollers have the potential to create a vibration within the vicinity of the works. Vibration, to a lesser extent, is also anticipated to occur around the construction site due to the movement of materials and equipment by vehicles.

Vibration dissipates rapidly as it spreads and loses energy from its source, hence impacts from vibration are not expected to be discernible at receptors location over 50m away from the Project site. This will therefore not impact permanent receptors. Vibration during construction are likely to trigger a flight response from fauna, this is further assessed in Section 7.

Table 6-9 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 Impacts
Construction Site Noise – Noise from general construction activities	Negligible Negative	Other Solar Park Facilities	Low	Negligible to 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 the manufacturer recommended guidelines 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) is available from the manufacturer. • Consideration shall be given to hours of works during normal day time working hours (between Saturday and Thursday) and on Friday's or during official holidays. • 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 85dB(A).	Negligible

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
					• Where noise levels exceed 85dB(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.	
Vehicular Noise- Noise from the movement of construction vehicles	Moderate Negative	Other Solar Park Facilities	Low	Minor	• 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). • Ensure any appropriate permits are in place for deliveries to the site and any works performed outside normal working hours. • Notify residents in proximity to the access road of noisy activities or special deliveries of large equipment to be conducted nearby their dwellings with a minimum one week in advance. • Review vendor specifications and accept site plant & 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.	Negligible
	Negligible Negative	Al Qudra cycling track	Medium	Minor		Negligible
	No Change	Ghaf Tree Nursery	High	Neutral		
Construction vibration impacts (including vehicle vibration)	Negligible Negative	Other Solar Park Facilities (adjacent Phase III solar fields)	Low	Negligible to 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.	Neutral

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
					• Where practical, all vibratory generating equipment and activities shall be sited away from the Project boundary.	

6.4.2 Operational Phase

OPERATIONAL NOISE

During the operational phase, there will be very few specific Project noise sources. The only potential noise will be from occasional maintenance vehicle and the low magnitude humming from the electrical transformers (which is not expected to be discernible over 50m from source).

Due to minimal requirements for personnel onsite during operations, impacts from vehicles are not expected to be a major noise source. During emergencies, noise from the emergency generator may be discernible on-site, but unlikely to be noticeable at the nearest receptors. As such, noise impacts during the operational phase are considered negligible.

VIBRATION

As a PV power plant, the project will not contain any rotating, vibrating or major moving parts. It is expected that the project will have no discernible vibration impact during the operational phase.

6.5 Monitoring

The EPC contractor will undertake noise monitoring periodically during the construction phase of the project. The minimum expected requirements for 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 Monitoring Plan' as part of the respective construction or operational phases ESMS.

Table 6-10 Noise Monitoring Requirements

MONITORING	PARAMETER	FREQUENCY & DURATION	LOCATION
CONSTRUCTION			
Day time noise	Leq(A)	Weekly	Project boundary locations.
Nighttime noise			

7 TERRESTRIAL ECOLOGY

This chapter assesses the potential impacts on terrestrial ecology that may occur as a result of the Project's construction and operational activities and identifies recommended measures that can be implemented to mitigate and manage such impacts.

7.1 Standards and Regulatory Requirements

7.1.1 Federal Requirements

Federal Law no. (9) of 1983 on the Ban on Wildlife Hunting, Gathering and Destruction, (UAE Hunting Law) were introduced to protect biodiversity from degradation. In particular relation to this project, the first two articles i.e. Article 1 and Article 2 of this law ban the hunting, gathering or destruction of bird's eggs (including doves, orioles and small birds) and the hunting of deer of various kinds (Oryx, Gazelles), hares, wild cows (dugong) and mastigures ('dhubs' and spiny-tailed lizards) respectively.

Federal Law No. 24 of 1999 for the Protection and Development of the Environment establishes the framework for the protection of the environment in the UAE, and specifies the following relevant objectives:

- Protection and conservation of the quality and natural balance of the environment;
- Control of all forms of pollution and avoidance of any immediate or long-term harmful effects resulting from developments;
- Conservation of biological diversity; and
- Compliance with international and regional conventions.

7.1.2 Lenders Requirements

IFC Performance Standard 6 requires the consideration of relevant threats to biodiversity and ecosystem services, especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution. Performance Standard 6 outlines that impacts on biodiversity and ecosystem services should be avoided where possible. When avoidance of impacts is not possible, measures to minimise impacts and restore biodiversity and ecosystem services should be implemented.

This ESIA has considered relevant threats to biodiversity and ecosystem services, focusing on habitat loss, degradation, fragmentation and pollution during the construction and/or operational phases of this project.

7.2 Observations and Baseline Conditions

The baseline condition of this section has been informed by:

- Review of satellite imagery;
- Review of information available from online resources;
- Numerous site visits (April 2020);
- Project Dusk Ecological Surveys (April 2020);
- Validation transect ecological surveys (26th to 29th April 2020);
- 24-hours wildlife capture survey at three locations on two occasions.

7.2.1 Al Marmoom Conservation Area

Based on the updated Affection Plan for the 5,013MW Mohammed Bin Rashid Al Maktoum Solar Park (see Figure 7-1 below), the entirety of the MBR Solar Park is located within the Al Marmoom Conservation Reserve. It is noted that the conservation reserve as designated in 2018, includes the solar park as an integral part of the conservation area.

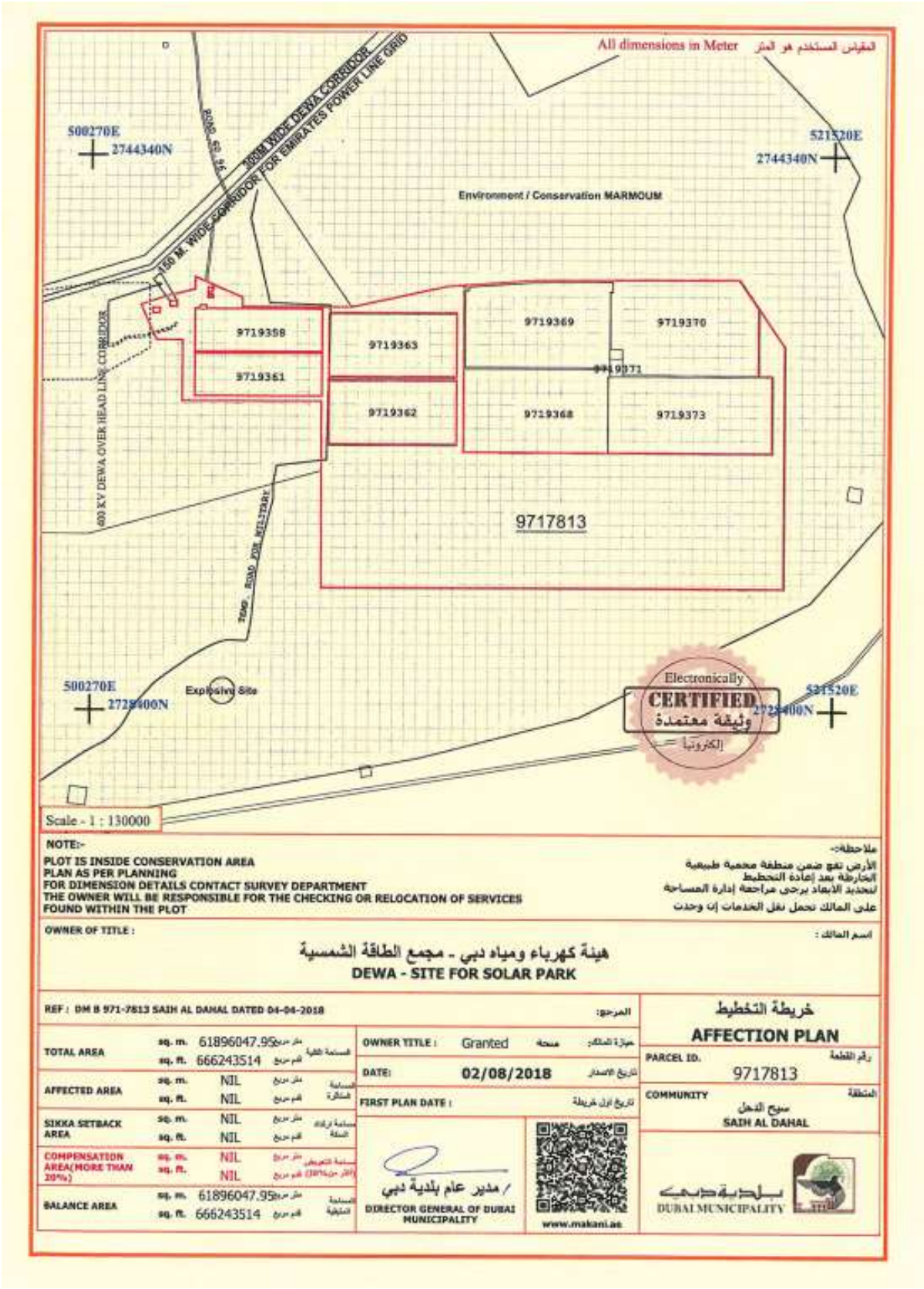
According to the Dubai Municipality fact sheet, Al Marmoom Conservations Reserve is 'one of Dubai's biggest protected areas, covering around 9% of the total land area of Dubai, Al Marmoom Conservation Reserve stretches over 361.95 hectares along the sands of the vast desert providing a delicate ecosystem for various wild animals like the Arabian Oryx, Sand Gazelle, Arabian Gazelle and several migratory birds'. It is understood that the Al Marmoom Conservation Reserve has been the recipient of various translocated species in the past from a range of different sites across the UAE, the Al Maktoum International Airport being one of them. Some of the translocated species include the Ghaf tree, Persian wonder gecko, Spiny Tailed Lizards (Dhubs), Desert Monitor, Snakes, Blue-headed Agama, hedgehogs and scorpions. The receiving location within the conservation area is approximately 10km to the northwest from the project site, close to the D42 (Seeh Al Salam st).

The reserve is classified as category II (National Park) under the IUCN Protected area category serving as a home to 187 birds, 26 reptiles, 15 mammals and 57 flora, with 4 species listed in the IUCN Red list including the Arabian Oryx and the Sand Gazelle.

Al Qudra Lakes (an area of man-made lake habitat) is approximately 7.5km from the northeast region of the Solar Park boundary and accommodates a variety of bird species in the winter months. As identified in the scoping stage, there are no recorded bird flyways within the Project locality as all bird flyways have been identified and recorded to be outside the Project vicinity and the wider Solar Park by the BirdLife International Bird Sensitivity Mapping Tool[2].

[2] **Source**: https://maps.birdlife.org/MSBtool/ Accessed 8th May 2018

Figure 7-1 Affection Plan for the 5,013MW MBR Al Maktoum Solar Park



7.2.2 Habitat Classification

The project area can be categorised into 4 habitat types (Figure 7-3)

- Gravel Plains interspersed with sparse vegetation (dwarf shrubs species dominated by *Tetraena qatarense and Tetraena simplex)*.
- Sand sheets and dunes with tree cover (sporadic mature Ghaf trees, *Prosopis Cineraria) and* interspersed with grasses (*Cyperus Conglomeratus)*.
- Sand sheets and dunes with perennial herbs and graminoids
- Disturbed Ground

The habitat classification used for this project is based on Brown and Boer's, "Interpretation manual of the major terrestrial natural and semi-natural habitat types of Abu Dhabi Emirate v2.0". The most abundant habitat within the Project area is "Gravel Plains interspersed with sparse vegetation" followed by "Sand sheets and dunes with tree cover". The following figure and table illustrate the distribution of the habitats within the Project boundary.

Table 7-1 Habitat Distribution Within The Project Boundary

HABITAT	AREA IN KM²	PERCENTAGE
Gravel plains with sparse vegetation	7.28	71.58%
Sand sheets and dunes with tree cover	2.13	20.94%
Sand sheets and dunes with perennial herbs and graminoids	0.67	6.59%
Disturbed ground	0.09	0.88%
Total	10.17	100.00%

Figure 7-2 Habitat Distribution Within The Project Boundary

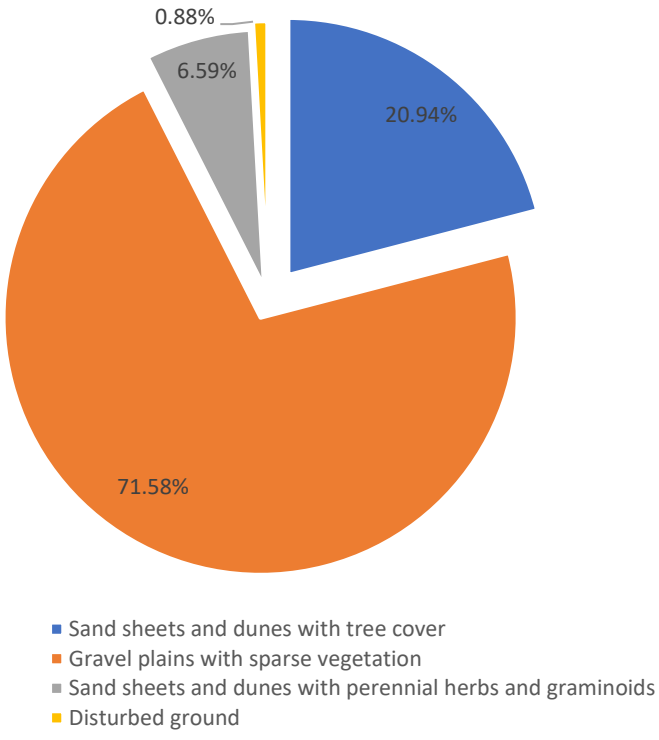


Figure 7-3 General Habitat types within Phase V

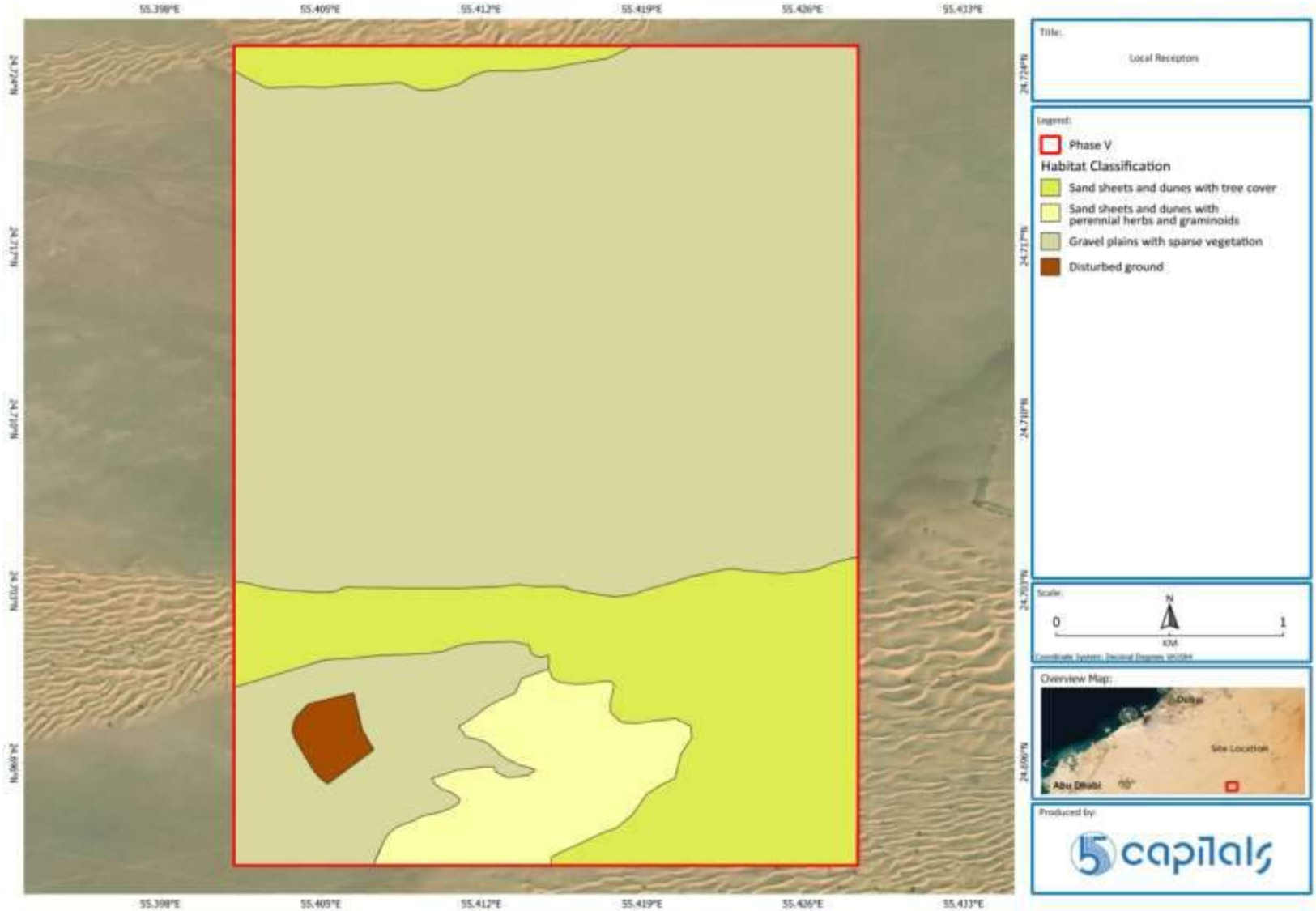


Plate 7-1 Gravel Plain with sparse vegetation (After Rain)

Plate 7-2 Sand sheets and dunes with tree cover

According to IFC Performance Standard 6, habitats directly or potentially affected by the Project should be classified as 'Natural', 'Modified' or 'Critical' for the necessary mitigation processes to be applied.

According to PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources and the applicable guidance note (IFC 2012, updated 2019), Critical habitats are areas with high biodiversity value, including:

- Criterion 1: Habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species;
- Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;
- Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
- Criterion 4: Highly threatened and/or unique ecosystems;
- Criterion 5: Areas associated with key evolutionary processes.
- Criterion 6: IUCN Protected Area Management Categories I-II; and
- Criterion 7: Internationally Recognised Areas including the majority of Key biodiversity Areas (KBAs).

IFC recognises that the determination of critical habitat is not limited to the 7 criteria considered above. Other recognised areas of high biodiversity value might also support a critical habitat designation and the appropriateness of this decision would be evaluated on a case-by-case basis. Examples include:

- Concentrations of Vulnerable species in cases where there is uncertainty regarding the listing.
- Habitat is necessary for the survival of keystone species.

Justification for the Project as being located in a critical habitat has been provided below.

- The Project site is located within the Al Marmoom Conservation Area, an IUCN category II protected area. The Conservation area is known for its admirable sustainability initiatives, the reserve is abundant with native wildlife and hosts one of the largest populations of Arabian Oryx in Dubai. It also provides shelter to many other threatened and endemic species (to the region) that have been successfully relocated to the area, such as the Persian or Arabian Wonder Gecko. This meets the requirements to trigger criterion 6 (above).
- In addition to its location within a conservation area, the Project site can also be considered a highly threatened ecosystem due to the presence of three threatened species. The Arabian Oryx, Arabian Sand Gazelle and the Arabian Gazelle are all classified as 'vulnerable' (Vu) by the IUCN Red List of threatened species. These three species are also considered endemic to the Arabian Peninsula. While not enough to trigger criterion 2 (above), the combination of their limited range and threatened status makes the habitat of importance. Fencing the Project site will restrict the movement of these species and reduce available area for their

foraging opportunities. This meets the requirements to trigger criterion 4 of the Performance standard.

- The Project site is also home to the locally protected Ghaf tree. While the said tree is classified as "not evaluated" by the IUCN, it is considered a species of special interest due to its status as a keystone species within the UAE desert habitat where it serves as a dune stabilizer. Furthermore, the Ghaf Tree was declared the national tree of the UAE in 2008 because of its cultural and traditional significance to the local community.

It should be noted that the key fauna species (Oryx and Gazelle) are mostly confined to the dune habitat with Ghaf tree cover. Taking all of the above into consideration, the "Sand sheets and dunes with tree cover" habitat within the project site can be considered a "Critical Habitat".

While the "Gravel Plains interspersed with sparse vegetation" habitat is considered "Natural Habitat". Small sections within the Project area can also be considered as 'modified habitat' as these areas have been affected by human activities. This includes the "disturbed ground" shown on the habitat map (above), and a decommissioned Oryx feeding station that was previously located in the Project site but has since been removed and begun reverting to natural habitat due to sand movements.

7.2.3 Ecological Survey

METHODOLOGY

Ecological surveys conducted in 2020 were undertaken via a combination of walkover transects and drive–over for general observations to cover the large scale of the project site. Transects of 100m length were surveyed within two dune habitats, a gravel plain habitat and an area of disturbed ground. These transects were walked during daylight and dusk/night periods by two members of the survey team. All flora and fauna species encountered including animal tracks & existential traces of fauna were examined and properly documented and any burrows or debris identified were closely inspected for evidence of any activity, especially for the endemic Spiny-tailed Lizard (*Uromastyx aegyptia leptieni*).

Three (3) wildlife trail cameras were installed in secluded areas of the dune habitats (temporarily attached to trees) and were left for 24-hours (on two occasions) to capture/identify any fauna species that were active at dusk and night (i.e. nocturnal species) and those active at dawn. The rationale for installing the trail cameras at the dune habitats only was since this is the primary habitat that supports those fauna species within the project area that are of IUCN conservation value.

Although there are no recorded bird migration flyways within the Project site, potential impacts upon avifauna cannot be completely ruled out due to potential impacts of 'lake effect'. Hence, incidental sightings of avifauna were made during the surveys on-site.

Figure 7-4 Ecological Survey Locations

Figure 7-5 Camera Trap Deployment Locations

Ghaf Trees

Due to the Ghaf tree's protected status and relative abundance on-site, any Ghaf tree observed during the various site visits were recorded. A total of 34 Ghaf trees were identified and their locations are illustrated in figure 7-5 below. The Ghaf trees are to be translocated in line with the Ghaf Tree Translocation Plan before any work is to commence in areas of Ghaf Trees.

Other Flora

All other Flora species observed during the ecological survey was recorded and identified. The results are presented in the tables below

Figure 7-6 Ghaf Trees within Project Site

Table 7-2 Flora Species within the Project Boundary

Scientific Name	Common Name	IUCN Category	Abundance On-Site	Photo
Chrozophora oblongifolia	Tanoom	Least Concern	Rare	
Tetraena simplex	Hureim	Least Concern	Abundant	

Scientific Name	Common Name	IUCN Category	Abundance On-Site	Photo
Tetraena qatarense	Haram	Least Concern	Abundant	
Arnebia hispidissima	Al Hamra	Least Concern	Rare	

Scientific Name	Common Name	IUCN Category	Abundance On-Site	Photo
Fagonia Indica	Shekaa	Not Evaluated	Abundant	
Prosopis cineraria	Ghaf	Least Concern	Abundant	

Scientific Name	Common Name	IUCN Category	Abundance On-Site	Photo
Cyperus conglomerates	Thenda	Least Concern	Abundant	
Prosopis juliflora	Ghoeif	Invasive Species	Rare	

Fauna

Fauna species identified within the Project site are presented in the tables below

Table 7-3 Fauna Species within the Project Boundary

SCIENTIFIC NAME	COMMON NAME	IUCN CATEGORY	ABUNDANCE ON-SITE	PHOTO
Gazella marica	Sand Gazelle or Mountain Gazelle	IUCN classification – Vulnerable (VU) due to a low and declining population. Common to the habitat type in the UAE.	Common	 File Photo
Gazella Arabica	Arabian Gazelle	IUCN classification – Vulnerable (VU) Common to the habitat type in the UAE.	Common	 *File Photo: (*www.inaturalist.org*)*

Scientific Name	Common Name	IUCN Category	Abundance On-Site	Photo
Scincus mitranus	Common Sand Fish	Not Evaluated	Common - Observed on all three camera traps.	*File Photo: (G. Simkins - www.ddcr.org)*
Oryx leucoryx	Arabian Oryx	IUCN classification – Vulnerable (VU) due to a low and declining population worldwide. Common to the habitat type in the UAE.	Common throughout the conservation area.	

Scientific Name	Common Name	IUCN Category	Abundance On-Site	Photo
Not identified	Not identified	Not Identified	Abundant	
Schistocerca gregaria	Desert Locust	Not Evaluated	Abundant	

Avifauna

Table 7-4 Avifauna Species Within the Project Site

Scientific Name	Common Name	IUCN Category	Abundance On-Site	Photo
Corvus ruficollis	Brown-necked raven	Commonly found in the UAE. IUCN classification of least concern.	Rare- Only one sighting of this bird species was noted during transect surveys (CT-2)	 File Photo
Streptopelia decaocto	Collared dove	Commonly found in the UAE. IUCN classification of least concern	Common - Observed on multiple occasions	 File Photo
Galerida cristata	Crested Lark	Least Concern (Population decreasing)	Rare - One incidental observation.	 File Photo

HABITAT CONSERVATION VALUE

The value of the habitats identified within the Phase V project location has been determined using the Ratcliffe Criteria (Ratcliffe, 1977). The Ratcliffe criteria assess nature conservation value using the following criteria.

- Size
- Diversity
- Naturalness
- Rarity
- Fragility
- Typicalness
- Recorded History
- Position in an Ecological/Geographical Unit
- Potential Value
- Intrinsic Appeal

Table 7-5 Habitat Value of the Phase V Project Site

SIZE	Approximately 10.2km^2
DIVERSITY	The Project site consists of a mixture of two habitat types; gravel plains and dunes. The gravel plains are primarily found in the northern, western and some portion of the southern extent of the site while the dunes are majorly found at the eastern, southern and the centre portion of the site. The most ecologically diverse area of the projects is the dunes. They are home to a diverse selection of species that include the Arabian Oryx, Arabian Gazelle, various reptiles such as the Common Sand Fish and Toad-Headed Agama as well as the locally protected Ghaf tree. The gravel plains normally void of vegetation and wildlife were covered in shrubs, most commonly Tetraena qatarense. The abundant vegetation, in turn, attracted large swarms of locusts and caterpillars.
NATURALNESS	Except for the Oryx feeding area (since removed) identified within the project area and a small area of disturbed ground, there is no other historical evidence of human activity or anthropomorphism.
RARITY	The Ghaf tree, protected under UAE federal law were identified within the Project site during the survey. The Arabian Oryx and Arabian Gazelle listed as "Vulnerable" on the IUCN red list were identified within the dunal areas of the Project site. Suggesting the Site contains fauna species of IUCN conservation value.
FRAGILITY	Development of the project will result in a minimal change in the gravel plain habitats within the Project site. However, site clearance will ultimately result in the removal of Ghaf trees which are foundational species for the dunal habitats and a support function to fauna species.
TYPICALNESS	Open gravel plain with minimal vegetation and interspersed with dune habitat containing active wildlife are common in the UAE and much of the Middle East.

RECORDED HISTORY	Gazelle, Arabian Oryx, reptiles and other mammals have been identified to be within the Solar Park and in the immediate surroundings of the park. However, there is no available historical data regarding the population dynamics of species within the Project site and satellite imagery suggests very little change to the site in recent history.
POSITION IN AN ECOLOGICAL/ GEOGRAPHICAL UNIT	The Al Marmoom Conservation Reserve surrounds the entirety of the Project site. There are no existing restrictions within the Project site to prevent wildlife movement from the adjacent site with similar habitat. Ghaf trees present at the dunal areas within the Project site are likely to support a population of large and small mammals, reptiles and invertebrates.
POTENTIAL VALUE	Taking into consideration the presence of fauna species of conservation interest and the fact that the site contains Ghaf trees that are likely to support ecosystem dynamics, the dune habitat within this Project site may have the potential to provide nature conservation value.

7.3 Receptors

Table 7-6 Terrestrial Ecology – Receptor Sensitivity

Receptor	Sensitivity	Justification
Gravel Plain Habitats	**Low**	This habitat type is widely spread across the United Arab Emirates and species of conservation significance were not identified within this habitat during ecological surveys.
Sand Dunes Habitats	**Medium**	Although abundant in the UAE, ecological surveys showed that this habitat supports fauna species of IUCN conservation value as well Ghaf trees which are important flora species in the UAE hence, this habitat type is relatively vulnerable.
Site grasses, shrubs and low vegetation	**Low**	Site grasses, shrubs and low vegetation are common to the region and are of low ecological value or vulnerability.
Ghaf Trees	**High**	The Ghaf tree is protected under the Federal Law No.24 of 1999 on 'Protection of the Environment'. Removal uproot or damage of any tree without authorization from competent authority is prohibited. Ghaf trees within the project area are a foundation species for the dune ecosystem and provide a support function for Gazelle and Arabian Oryx which are both species of conservation significance.
Fauna – Small mammals and reptiles	**Low**	Small mammals and reptiles are common to the region and are not of any conservation significance. The endemic Dhub or Spiny Tailed Lizard was not observed on site.

Receptor	Sensitivity	Justification
Fauna – Large mammals and reptiles, e.g. Arabian Oryx and Gazelle	**High**	Oryx and Gazelle are of IUCN 'Vulnerable' Conservation Status due to low population numbers in the wild. The individuals present within the project site are of high value given their contribution to the increase in population their respective species.
Avifauna	**Medium**	Bird species identified within the Project site are commonly found in the region and are of least concern under the IUCN Red List.

7.4 Potential Impacts

7.4.1 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. Such impacts may include the partial or direct loss of habitat and flora species as well as disturbance to fauna.

LOSS OF HABITAT

Site preparatory works will result in a major adverse impact for all habitats within the Project area due to the complete removal of all vegetation, surface soils and debris 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 building.

The construction works will result in the loss of a calculated as 10.17km^2 of terrestrial habitat and associated ecosystem. This includes the dune habitat that supports important fauna species particularly the Arabian Oryx and Gazelles as well as flora species such as the protected Ghaf Trees which serves as a foundation species for the dune ecosystem and a support function to Gazelles and the Arabian Oryx.

It should be noted that the Conservation Area has a total size of 961.10km^2. Therefore the expected habitat loss to occur because of the construction work can be calculated as 1.06% of the total available habitat within the conservation area. Keep in mind this does not take into consideration the already developed areas inside the conservation area such as the other phases of the solar park and the residential areas, Al Lisaili and Murquab.

Furthermore, it is important to consider that out of the 10.17km^2 habitat that is expected to be lost only about 20% are classified as "Critical habitat"(Reference Section 7.2.2) and therefore of conservation value. This means only 2.13km^2 of habitat with a high conservation value will be lost during construction. That is only 0.22% of the total available habitat within the Conservation area.

Table 7-7 Conservation and Project Area Sizes

NAME	AREA (KM^2)
Conservation Area	961.10
Phase V Project Area	10.17
"Critical Habitat" within Project Boundary	2.13

HABITAT FRAGMENTATION

The project is located in a wide area of natural habitat (within the Al Marmoom Conservation Area) that is generally open and free of barriers to animal movement (i.e. fences). Loss of habitat and fencing of the project site may increase the division of the natural habitat. However, given the widespread availability of natural habitats within the immediate vicinity of the Project site, fauna species will be able to move out of the Project area.

DISTURBANCE TO FAUNA

Dust impacts may also be a nuisance to fauna, however, considering that these species are native of the UAE, it can be assumed that they can tolerate generally sandy conditions to some degrees, and It is also expected that these animals will avoid these Project areas during construction.

Construction activities will also generate noise & vibration during daytime and lighting during night-time works, which could potentially cause disturbance of ecological receptors (such as large and small mammals and reptiles). A flight response is likely to be triggered for any fauna within the project area once construction works commence. However, reptiles and small mammals may choose to take shelter in their burrows, in which case there is a potential for the use of construction equipment to injure or kill such species in the Project area.

Table 7-8 Terrestrial Ecology Impact Significance, Mitigation and Management Measures and Residual Impacts – Construction

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures*	Residual Impacts
Loss of Gravel Plain Habitat	Moderate Negative	Gravel Plain Habitats within Project Site	Low	Minor	• Development of a Biodiversity Action Plan (BAP) for submission to (and in coordination with) DM-NRCS to outline the plans for fauna and flora translocated (as below) and follow up monitoring of such activities (including survivability). • All vehicles and equipment movements to be restricted to within the project boundaries when working on-site. Appropriate signage (i.e. NO ENTRY) should be installed at strategic locations to avoid disturbance of sensitive adjacent habitats. • EPC Contractor's staff to receive awareness training on the conservation value of habitats and key species (see below) within the Project site and its surroundings. • It is strictly prohibited to remove or damage any Ghaf Trees, or to attempt to move reptiles or mammals; which must only be undertaken by DM licensed professional and in line with the respective translocation plan or BAP (as applicable). • Workers will be advised not to remove or damage other flora and fauna on-site which is not in their immediate working area.	Negligible to Minor
	Moderate Negative	Site grasses, shrubs and low vegetation	Low	Minor		Negligible to Minor
Loss of Sand Dune Habitat	Moderate Negative	Sand Dunes Habitats	Medium	Moderate		Minor to Moderate
	Moderate Negative	Site shrubs and low vegetation	Low	Minor		Negligible to Minor
	Moderate	Ghaf Trees	High	Moderate to Major		Minor
	Moderate Negative	Fauna – Large mammals and reptiles, e.g. Arabian Oryx and Gazelle	High	Moderate to Major		Minor
Habitat Fragmentation	Minor Negative	Fauna – Small mammals and reptiles	Low	Negligible to Minor		Negligible to Minor
	Moderate Negative	Fauna – Large mammals and reptiles, e.g. Arabian Oryx and Gazelle	High	Moderate to Major		Minor

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures*	Residual Impacts
					• Translocation of key flora and faunal species should be undertaken as per the relevant Translocation plan before any site clearance or levelling activities. Key Species include; - The Protected Ghaf tree - Arabian Oryx - Arabian Gazelle (Not Observed during baseline) - Arabian Sand Gazelle - Spiny Tailed Lizard (Not Observed during baseline) • In coordination with Dubai Municipality Natural Resources Conservation Section (DM-NRCS), or the horticultural department (fo Ghaf Trees), translocation shall be to a pre-determined suitable location within the Al Marmoom Conservation Reserve (and outside the boundaries of the 5,013MW MBR Solar Park). • Translocation activities must be coordinated and supervised by a qualified Arborist, and strictly follow the DM guidelines, with a collection of associated evidence as proof of translocation. • Site clearance is to be planned in one direction to minimise the risk of trapping any fauna within the Project site.	

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures*	Residual Impacts
					• Any sightings of key fauna species on-site must be reported to the Environmental Manager, who will inform DM and the necessary professionals to ensure translocation. Key Species include; - Arabian Oryx - Arabian Gazelle (Not Observed during baseline) - Arabian Sand Gazelle - Spiny Tailed Lizard (Not Observed during baseline) • The Project area boundaries should be established and isolated through the installation of a fence to avoid stray fauna from venturing back into the active construction area.	
Dust Emissions	Moderate Negative	Fauna – Large mammals and reptiles, e.g. Arabian Oryx and Gazelle	High	Moderate to Major	• Land clearance (or grading) is to be limited to within the boundaries of the Project site (or access road works only). • Dust generation mitigation measures to be followed for construction works (e.g. damping/spraying of water for dust suppression. ref. Air Quality chapter). • All vehicles and equipment movements to be restricted to within the project boundaries when working on-site. • No off-road driving outside the Project boundary to avoid any damage to the dune habitat or unnecessary dust emissions.	Minor

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures*	Residual Impacts
Noise, Vibration and Lighting Disturbance to Fauna	Moderate Negative	Fauna – Small mammals and reptiles	Low	Minor	• Applicable permits to be in place (via DM) for all night-time construction works. • The Project will minimise light spill as much as possible by directing all lights into the site area to minimize the amount of artificial light reaching adjacent areas outside the Project footprint. • Noisy construction activities and equipment after retrofitting with noise abatement technology (ref. ESIA Noise chapter) should be sited away from project boundaries and as far as practicable possible from dune areas. • Appropriate training should be provided to relevant personnel (i.e. HSE Managers and HSE staff) concerning noise, vibration and lighting control and management.	Negligible to Minor
	Moderate Negative	Fauna – Large mammals and reptiles, e.g. Arabian Oryx and Gazelle	High	Moderate to Major		Minor

* Please see separate section below concerning mitigation justification for IFC PS6 compliance.

7.4.2 Operational Phase

HABITAT FRAGMENTATION

The development and fencing of Project site boundary will prevent any future passage of large fauna (such as Gazelles and Arabian Oryx) through site Project land resulting in habitat fragmentation. However, given the widespread availability of natural habitats within the immediate vicinity of the Project site and the wider Al Marmoom Conservation Reserve, these fauna species will be able to move out of the Project area or will be translocated to the adjacent dune habitats.

Lizards, small mammals and other reptiles that may have abandoned their burrows during construction works could return to the site, however perimeter fencing is likely to restrict access for larger individuals.

With regards to flora, small pockets of pioneer species may return to the area from the existing seedbed or adjacent areas wherever there are exposed soils amongst the PV panels; although these will be managed during operations to prevent potential impacts of shading on PV modules. It is not anticipated that Ghaf trees will return to the project area following construction.

Inappropriate landscaping using non-native or non-naturalised species could result in the introduction of invasive species to the region or requirements for the unnecessary use of pesticides and fertilisers.

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 the'lake effect'. Although lacking firm research, there is a suggestion amongst the scientific community and avian protection bodies that the 'lake effect' has the potential to injure birds or lead to their mortality where birds attempt to land on the PV panels, a potential phenomenon whereby birds mistake the reflective surfaces of solar PV panels for a water surface.

However, as there are no recorded flyways within the Project site and the Project site is largely devoid of any foraging or roosting opportunities, avian species are not expected to fly over or use the Project site as supporting habitat.

NOISE IMPACTS

Besides maintenance vehicles and a potential low magnitude humming from the electrical transformers (which is not expected be discernible at over 50m distance from the source), there is little noise expected during operations. As the magnitude of noise impacts are minimal, further assessment has not been undertaken.

Table 7-9 Terrestrial Ecology Impact Significance, Mitigation and Management Measures and Residual Impacts - Operation

Potential Impacts	Magnitude of Impact	Receptor	Receptor Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
Habitat Fragmentation	Minor Negative	Fauna – Small mammals and reptiles	Low	Negligible to Minor	• Any key faunal species (small and large) encountered within the project footprint should be reported to DM-NRCS for relocation. Key Species include; - Arabian Oryx - Arabian Gazelle - Arabian Sand Gazelle - Spiny Tailed Lizard (Not Observed)	Negligible to Minor
	Moderate Negative	Fauna – Large mammals and reptiles, e.g. Arabian Oryx and Gazelle	High	Moderate to Major		Minor
Bird Mortality	Minor Negative	Avifauna	Medium	Minor	• Bird mortality monitoring (incidental sightings). The trend of bird mortality should be appropriately recorded and analysed in coordination with relevant government agencies (i.e. DM).	Minor

7.5 Mitigation Measures

In line with the identification of a 'critical habitat' (refer to the baseline above), it is necessary to follow the mitigation requirements established by IFC Performance Standard 6. This necessitates that the Project will not implement activities in areas of critical habitat unless all of the following requirements are met:

- No other viable alternatives within the region exist for the development of the project on modified or natural habitats that are not critical;
    - The Project location has been chosen by DEWA within the defined Mohamed Bin Rashid Al Maktoum Solar Park area. The location of the Phase V project has been defined and is not flexible and does not require other processes such as land acquisition and resettlement.
    - Despite this, the majority of other available, open land in Dubai (on the scale of the Phase V project - i.e. 10km2) is of a very similar condition and likely to be considered 'critical'. Land that is not critical habitat (based on similar characteristics of Ghaf trees and similar species compositions) is likely not of sufficient size for a Project of this scale or it privately owned and therefore will require land acquisition and resettlement.
    - Further, given the location of the solar park and existing associated infrastructure (such as roads, substations, power lines and water pipelines), there are already suitable services in place (some common) to justify not developing such facilities in alternate locations in the Emirate; which may lead to further fragmentation of habitats.
- The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
    - For a full reference of the habitat definition as 'critical' please refer to the baseline section of this chapter. In summary, the Project site has been identified as a Critical Habitat because of the presence of the locally protected Ghaf tree and three vulnerable fauna species found in the dune habitat. In addition to this, the Project site is located within the Al Marmoom Conservation Area. However, it is highlighted that the solar park is an integral part of the reserve.
    - It is planned for Ghaf Tree and fauna (Mammals and Reptiles) to be translocated to a managed location elsewhere within the conservation area before the start of construction. As such, there should not be a measurable adverse impact on these species.
- The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period; and
    - This is not applicable as there are not critically endangered or endangered species identified in the Project area.
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program are integrated into the client's management program.

- A Biodiversity Action Plan (BAP) and Ghaf Tree Translocation Plan will be developed by the EPC Contractor. The BAP will provide robust and in-depth biodiversity processes to align with the mitigation measures above, while the separate CESMP will contain the associated long-term monitoring measures.

As the interpretation stated above justifies that the appropriate requirements (above) can be met, the Project's mitigation strategy will need to be described in a Biodiversity Action Plan and will need to achieve 'net gains' of those biodiversity values for which the critical habitat was designated.

ACWA Power are commited to achieving a "Net Gain" trhough a feasible strategy that will be developed post financial close. At this stage they commit to the following mitigation strategy that will result in a "No Net Loss".

ACTION PLANNING

- As is outlined above, a BAP and Ghaf Tree Translocation Plan have been developed for the Project specifically.

GHAF TREE TRANSLOCATION

- In line with legal requirements in Dubai, the Ghaf trees will be translocated to a managed area under NOC from the Dubai Municipality Horticultural Department (commonly in coordination with the RTA, who also assist with tree translocations along road corridors).
- The translocation area has not specifically been confirmed and is subject to DM confirmation. Based on the knowledge of other MBR Solar Park Projects, the translocation is expected to be within a managed area of the Al Marmoum Conservation Area (such as the Al Qudra Lakes), that will include irrigation network. It is noted that as per the translocation plan, the Ghaf Trees will be monitored for a period (6-monthly for 1-year), with monitoring reports submitted to DM-NRCS (already agreed under the contract between the EPC Contractor and a local consultancy).
- We highlight that the translocation of Ghaf Trees to a similar dune habitat may not be viable and may result in a high-level of mortality. This is primarily due to the deep and extensive root system (to search and feed off groundwater) that as part of the translocation process needs to be cut back to make translocation possible. With translocation directly to dunes, trees roots may not easily reach the water table, which would impact the survivability of the trees (unless irrigation is installed). As such, an irrigated solution is necessary for survival.
- The translocation recipient site (such as the Al Qudra lakes and the surrounding area), is becoming a popular destination for Dubai residents and is also a fundamental component to enhance the conservation area, particularly for visitors, and education concerning the various flora and fauna found within the UAE and their importance to the region. This can be considered a 1st step in the process to achieve a net gain on top of the managed translocation.

FAUNA TRANSLOCATION

- It is primarily expected that large mammals species (i.e. Oryx and Gazelle) which roam the wider open areas will avoid the human activity when this is established on-site. Depending on the process for fencing and due to the large area of the site, such species may return to accessible areas. If this occurs they will likely move away naturally but it will be necessary to ensure they have access off the site (i.e. not penned it).
- Translocation of reptiles and small mammals will be made before works. As per the baseline observations, such translocation is expected to be in limited numbers due to the large expanses of gravel plain habitat which did not exhibit evidence of burrows, or direct sightings of species.
- It is noted that the survival of species in the harsh desert environment requires a fine balance of water and vegetation availability and species numbers. Adjustments to species numbers/abundance (as influenced by translocation) may imbalance or otherwise impact the habitats carrying capacity. This will be assessed by reconnaissance surveys before translocations and a planning report will be sent to DM-NRCS for approval.

7.6 Monitoring

Table 7-10 Terrestrial Ecology- Monitoring Requirements

MONITORING	PARAMETER	FREQUENCY & DURATION	LOCATION	RESPONSIBILITY
Construction				
Flora	Ghaf Trees	Inventory of all trees and locations before any site clearance and levelling and provide a planning method statement for approval by DM-NRCS Advisory and selected supervision of contractor undertaking translocation. Ensuring all trees have been translocated from the project site. Bi-annual for the first year.	The entire Project area	EPC Contractor
Fauna	Arabian Oryx, and Gazelle	Daily visual observations for sightings of Gazelle and Arabian Oryx within the Project site.	In all working areas of the site.	EPC Contractor
Operation				
Fauna	Arabian Oryx, and Gazelle	Incidental visual observations for sightings within the Project site.	Within the entire Project site	O&M Company
Avifauna	Residential and Migratory Birds	Incidental visual observations for bird mortality. Record keeping concerning deceased bird species found.	The areas around the PV panels	O&M Company

8 GEOLOGY, SOILS AND GROUNDWATER

This chapter assesses the potential impacts that may occur to local geology, soil and groundwater as a result of the projects construction and operational activities and identifies the measures that will be undertaken and implemented to mitigate these impacts.

8.1 Standards and Regulations

8.1.1 Federal/Local Requirements

The proposed Project will be required to comply with the DM standards for the prevention of land contamination including Federal Law No. (24) of 1999 and Local Order No. 61 of 1991, which strictly prohibit the uncontrolled pollution of soils and groundwater.

Table 8-1 summarises Land Contamination Indicator Levels as provided by DM – Information Bulletin (May 2003) 'Environmental Standards and Allowable Limits of Pollutants on Land, Water and Air environment'.

Table 8-1 DM Land Contamination Indicator Levels

CONTAMINANT	ACCEPTABLE LEVEL (MG/KG)
Arsenic	50
Barium	400
Cadmium	5
Chromium (total)	250
Copper	100
Lead	200
Manganese	700
Mercury	2
Zinc	500
Selenium	2
Pesticides (total)	2
Fluoride	500
Phenol	1
Benzene	1
BTEX(total)	100
Chlorinated Hydrocarbons	1
Polychlorinated Biphenyls (PCBs)	0.5
TPH <C9	1,000
TPH>C9	10,000
Cyanide (free)	10

Note: Depending on the source, location and intended land use, the EPSS may specify stringent level where the health of expected receptors will be at risk or to maintain the background quality of the site.

Source: Environmental Standards and Allowable Limits of Pollutants on Land, Water and Air Environment.

8.1.2 Lender 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.

8.2 Observations and Baseline Conditions

8.2.1 Geology and Geomorphology

REGIONAL GEOLOGY

The UAE and Dubai lie over the Arabian Platform and is bounded to the north by the Arabian Gulf, to the east by Sultanate of Oman and to the south and west by the Kingdom of Saudi Arabia. The Arabian Platform is a Phanerozoic terrain consisting of clastic, calcareous and evaporitic successions dipping gently eastward away from the Arabian Shield. These sedimentary layers crop out as relatively flat-lying beds of sandstone, siltstone, limestone, and salt deposits that were deposited on the underlying Precambrian basement. Therefore, the age of the platform is from the pre-Cambrian to the modern era.

The youngest deposits in the region include coral limestone and unconsolidated sand, silt, gravel, and sabkha, which have accumulated in well-known areas such as the Rub al Khali and An Nafud, and have filled dried-up lakebeds and wadis, and fringed the coastlines[3].

The UAE is geomorphologically composed of mountains, gravel plains, sandy dunes, drainage basins and coastal plains. The coastal plains of the UAE rise gently towards the Hajar mountains consisting of granular soils (sands, gravels, boulders and cobbles), overlying tertiary limestone, shale, siltstone and sandstone) or crystalline rocks.

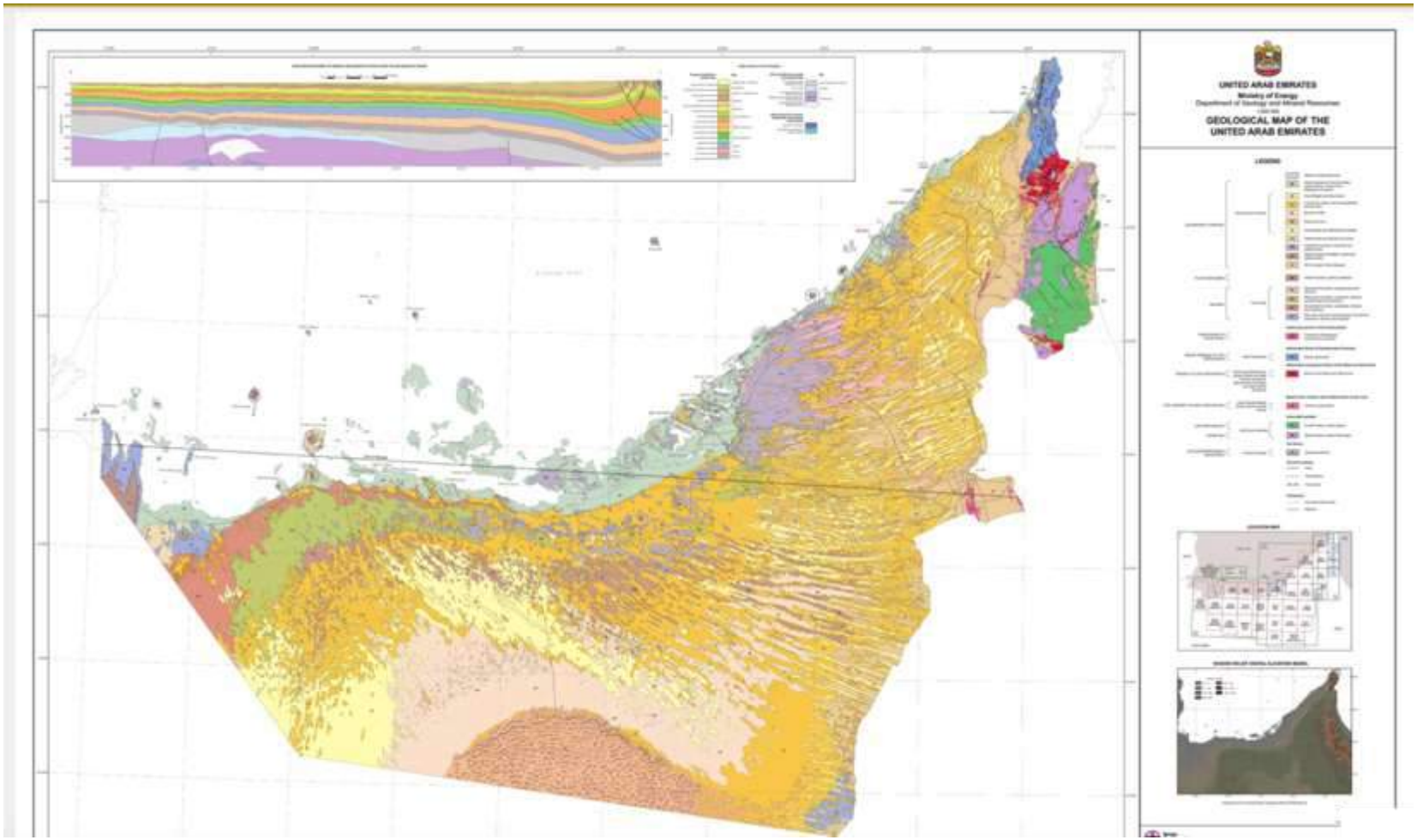
Except for the Hajar mountains located in the northeastern part of the country and along the border of the Sultanate of Oman, the country is relatively low- lying with near-surface geology

[3] Source: The Emirates a Natural History and Saudi Geological Survey

dominated by Quaternary to late Pleistocene age, mobile Aeolian dune sands, and sabkha/evaporates deposits.

The Hajar Mountains reach a height of 2000 metres. This area is known locally as Ru'us Al-Jibal which means the 'heads of the mountains'. The Ru'us Al Jibal exposes the thick sequence of Mesozoic carbonates of the Arabian Platform that correlates with the principal oil-bearing strata that lie deeply buried to the west.

Figure 8-1 Geological Map of the United Arab Emirates



Source: http://www.hayyakom.ae/?page_id=1135#. Accessed 6th May 2018. Originally from UAE Ministry of Energy, Department of Geology and Mineral Resources.

PROJECT SITE GEOLOGY

The geology of the Solar Park is mainly composed of lower Aeolian Plains with dunes and gravel plains with an elevation above sea levels that range from 100-110m in the western park to 130 -145m in the eastern part of the Solar Park (Dome 300MW EIA report 2016).

Before the change in the Master Plan, geological investigations have previously been undertaken within the boundaries of the solar park, in 2012 by ILF. Subsoils and bedrock encountered during the investigation included:

Limestone. White to grey limestone, mainly dense partly porous and of high strength.

Weak rock. Calcareous cemented, reddish sandstones and / or white to light reddish evaporitic rock (porous rock consisting of mainly calcite and secondarily gypsum.

Dense sand. Dense to slightly cemented, fine to medium-grained sand. Samples can be easily broken by hand. Sand is mainly consisting of carbonate grains.

Dune sand. Loose to medium dense, fine to medium-grained sands, light yellow.

Very loose sand. Fine to medium-grained sands, slightly silty, beige to light brownish with some gravel components. The thickness of this upper sand layer varies from few centimetres up to approximately 0.3 m. Sand is mainly consisting of carboniferous grains.

Surface soils noted from the site investigation within the project area comprise brown, very shallow, well-drained, gravelly loam and loose, fine-grained sands.

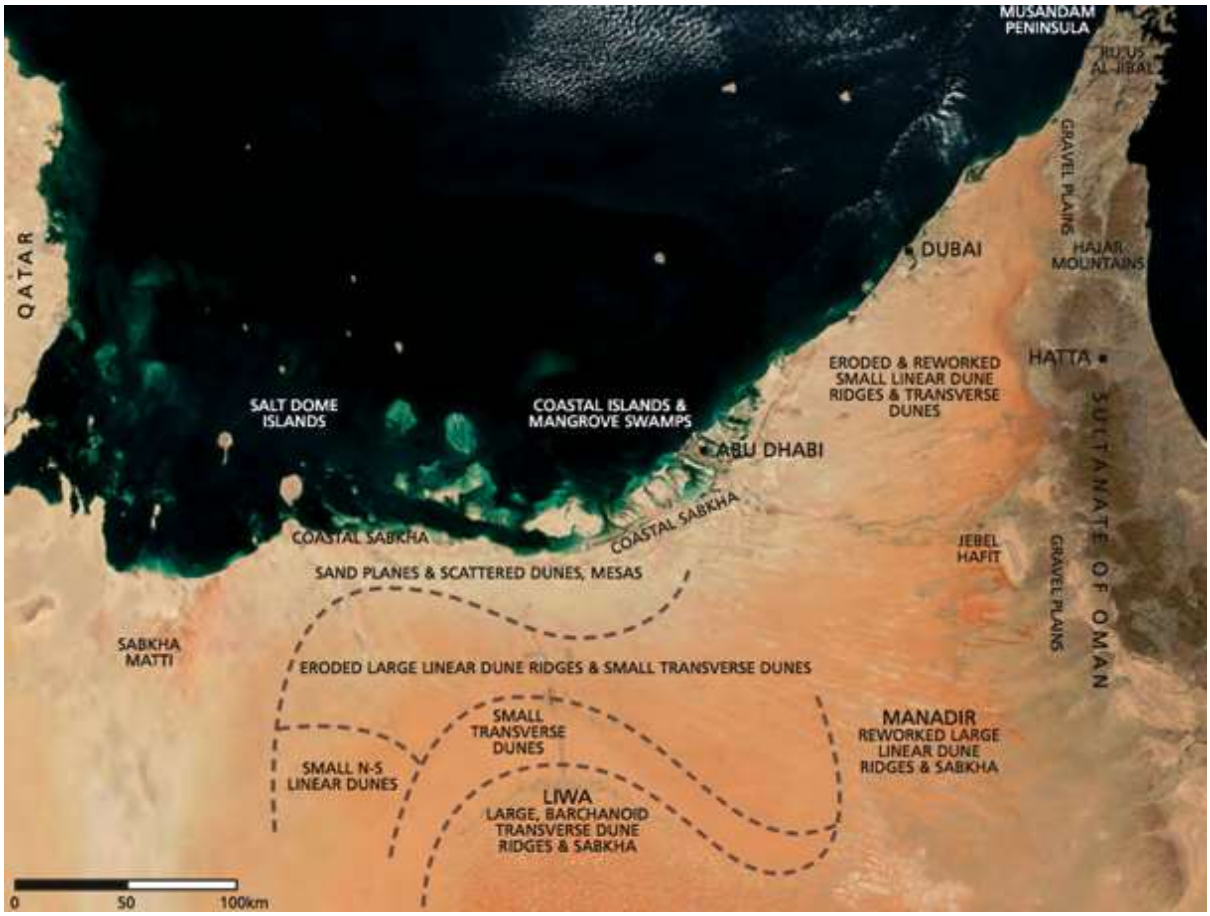
Features of specific geological significance (e.g. outcropping rocks or designated geological features) were not identified during the site visit. This is consistent with the local region which is characterised by low-lying dunes and sand/gravel interdunal plain.

GEOMORPHOLOGY

Most of the land surface of the UAE is a sandy desert, stretching from the Arabian Gulf coast south to the uninhabited sands of the Empty Quarter, the Rub' al-Khali, and east to the gravel outwash plains bordering the Hajar Mountains. The desert is a geologically recent feature, the result of prolonged subaerial erosion and re-deposition in an arid environment.

The sands overlie the thick, oil-rich sedimentary strata of the Arabian Platform, which constitute the bedrock of most of the UAE. The following figure presents the different geomorphological environments across the UAE including dunes, sabkha and mountainous formations.

Figure 8-2 Geomorphological Formations in the UAE



Source: The Emirates: A Natural History, 2005

8.2.2 Topography

The UAE is largely an arid land dominated by deserts ranging from flat sandy areas with rolling dunes in the south and extensive salt flats (sabkha) located in the west and along the Gulf Coast where the desert interfaces the sea. Mountains are located towards the east and wadis or dry valleys cuts through these mountains, opening out unto plains.

The topography of Dubai is significantly different from that of the southern portion of the UAE in that much of the city's landscape is highlighted by sandy desert patterns, while gravel deserts dominate much of the southern region of the country.

The Solar Park has variable topography, with some areas being predominantly flat while gravel plains and dunes are found in others. The dunal areas primary cover the northeastern and southern region of the Solar Park and consists of crushed shell and corals including locally protected Ghaf trees which tend to be located along dune ridges. The gravel plain areas are interspersed at the northern, western and eastern areas of the Solar Park and have a very small amount of low lying vegetation, shrubs and grasses; often in clusters and sporadic.

The Project site consists of the combination of dunes and gravel plains.

Plate 8-1 Topography of the Project Site- Dunal Areas

Plate 8-2 Topography of the Project Site- Gravel Plain Areas

8.2.3 Soil Quality

METHODOLOGY

Although the project is greenfield (in the vast majority) and not expected to be influenced by previous or other external pollution sources (due to its isolation), 5 Capitals conducted a soil investigation on 28th April 2020 to identify existing soil quality condition and characteristics.

During the soil investigation, surface soil samples were collected at eight (8) locations within the Project area. All sampling locations were selected to provide a representative soil condition for the site in general. This included a targeted effort to select sampling locations in both the dunal and gravel plains habitats. All soil samples were collected using stainless steel spade shovels at a depth of 10cm (0.1m) and taken to an EIAC accredited laboratory in Dubai (CORE Laboratories) for analysis. The analysis was done to ascertain the presence of potential soil subsurface contamination. Descriptions of the observed soil characteristics are presented in Table 8-4 & Table 8-5.

Table 8-2 Soil Sampling Coordinates

ID	DLTM COORDINATES	
	NORTHING (Y)	EASTING (X)
S-1	2735605.016m	508585.5297m
S-2	2734826.804m	508632.0878m
S-3	2733236.201m	509037.0187m
S-4	2732006.856m	508103.9691m
S-5	2732399.778m	507328.2654m
S-6	2731927.545m	508344.2882m
S-7	2732409.921m	507448.3598m
S-8	2732927.602m	507955.3633m

Note: 'S'-Soil Sample

Figure 8-3 Soil Sampling Locations

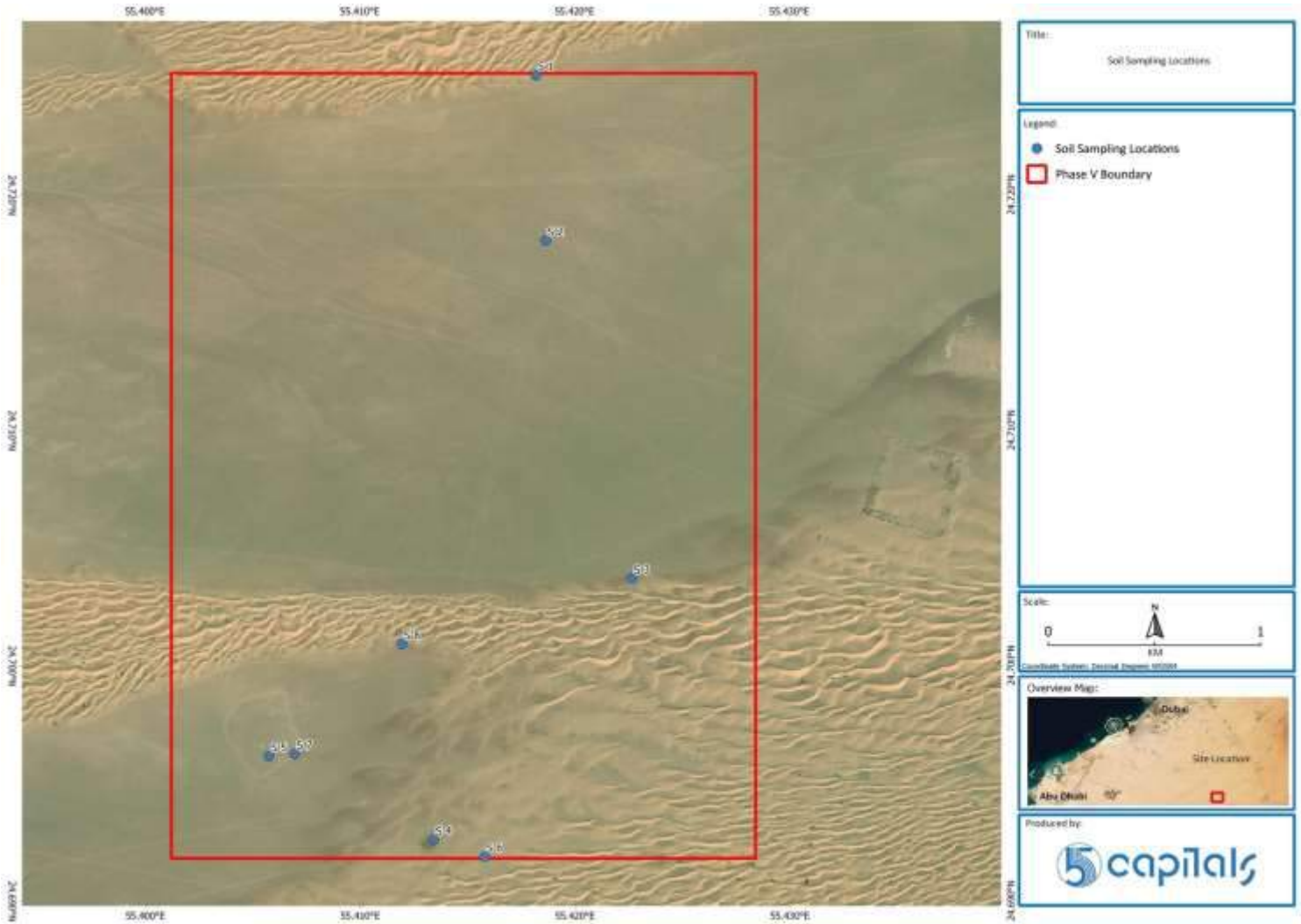


Table 8-3 Soil Sampling Observations

ID	OBSERVATIONS (SOIL CHARACTERISTICS)	PHOTO
S-1	Very loose unconsolidated fine sand. No organic matter.	
S-2	Unconsolidated fine gravel with some fine sand mixed within.	
S-3	Very loose unconsolidated fine sand. No organic matter.	
S-4	Very loose unconsolidated fine sand. No organic matter.	

ID	Observations (Soil Characteristics)	Photo
S-5	Unconsolidated coarse sand with some gravel and organic matter mixed within.	
S-6	Very loose unconsolidated fine sand. No organic matter.	
S-7	Unconsolidated coarse gravel with some sand and organic matter mixed within.	
S-8	Very loose unconsolidated fine sand. No organic matter	

'S'- Soil samples.

RESULTS

The soil samples obtained were analysed for the presence of heavy metals and Total Petroleum Hydrocarbons (TPH) as well as Nutrients. The results of the soil laboratory analysis are presented in Table 8-4.

Table 8-4 Soil Analysis Results

PARAMETER	MDL	UNIT	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	DM STANDARDS
Heavy Metals (mg/kg)											
Arsenic	5.0	mg/kg	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	**50**
Barium	1.0	mg/kg	34.7	46.6	75.6	93.2	144.3	47.7	153.8	52.7	**400**
Cadmium	2.0	mg/kg	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	**5**
Chromium	1.0	mg/kg	22.8	33.6	16.9	19.9	36.7	19.5	32	15.5	**250**
Cobalt	2.0	mg/kg	3.1	4.3	2.2	2.7	4.1	3	4.2	2.1	**-**
Copper	1.0	mg/kg	3.9	6.2	1.2	3.4	6.2	6.4	6.4	3.8	**100**
Lead	1.0	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**200**
Manganese	2.0	mg/kg	188.8	228.1	145	158	204.2	188.7	190.5	145.5	**700**
Mercury	1.0	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**2**
Nickel	2.0	mg/kg	27	36	21.8	27.9	40.2	26.3	41	22.8	-
Zinc	2.0	mg/kg	9.9	14.1	5.9	7.9	12.4	8.1	11.9	6.7	**500**
Total Petroleum Hydrocarbons (mg/kg)											
Gasoline Range C6-C12	2.0	mg/kg	< 2.0	< 2.0	<2.0	<2.0	< 2.0	< 2.0	< 2.0	< 2.0	-
Diesel Range C10 – C28	20.0	mg/kg	< 20.0	< 20.0	<20.0	<20.0	< 20.0	< 20.0	< 20.0	< 20.0	>C9: 10,000
Heavy Fraction C29 – C40	50.0	mg/kg	< 50.0	< 50.0	<50.0	<50.0	< 50.0	< 50.0	< 50.0	< 50.0	
Nutrients (mg/kg)											
Chloride as Cl	1.0	mg/kg	46	28	10	111	78	16	54	12	-
Nitrate as NO_3	1.5	mg/kg	24.9	< 1.5	31.8	162.5	< 1.5	< 1.5	< 1.5	< 1.5	-
Phosphate Phosphorus as PO_4	0.10	mg/kg	476.7	431.88	549.7	554.34	351.5	533.75	365.87	580.81	-
Sulfate as SO_4	1.0	mg/kg	59	45	8	24	279	51	2590	16	-

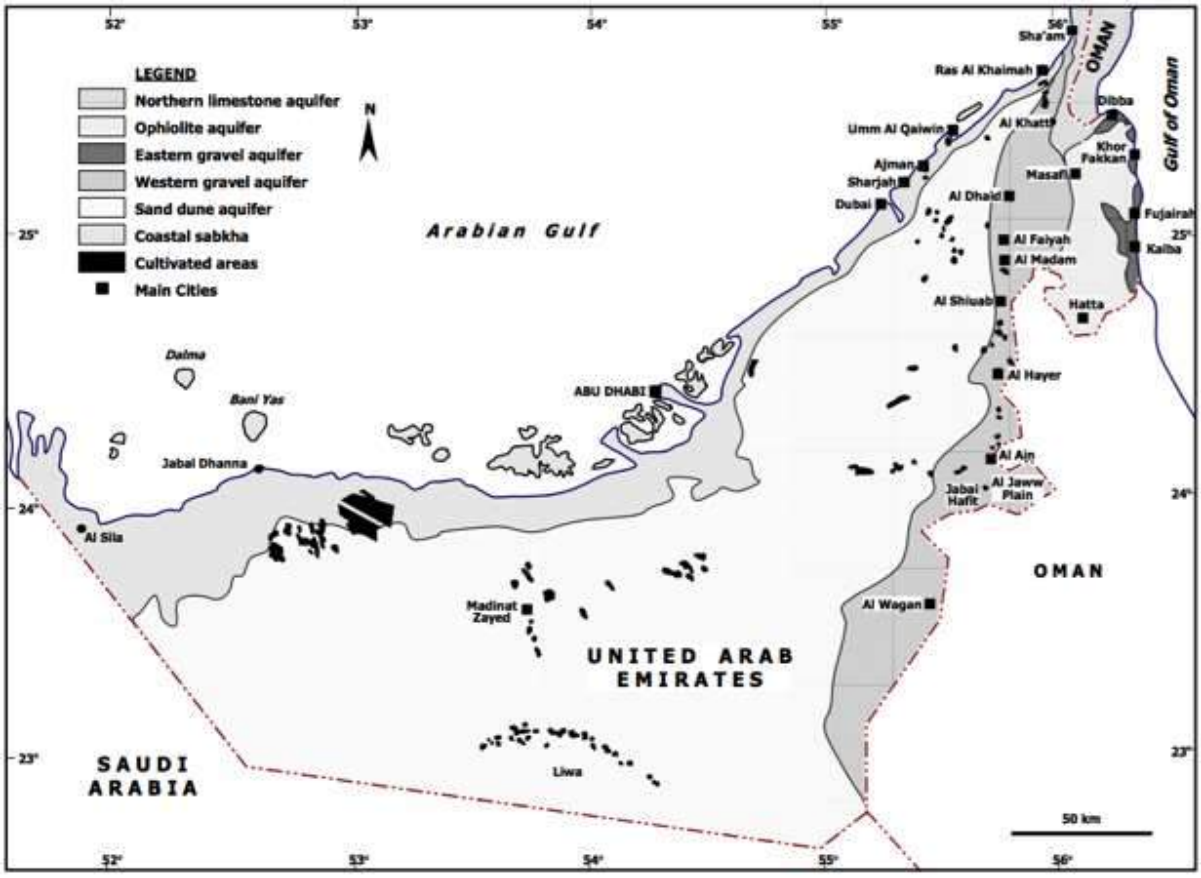
When the obtained results were compared with the Dubai Municipality soil standards it was evident that the pollutant concentrations in all the analysed samples were well below the Dubai Municipality Land Contamination standards for all parameters analysed and are in the ranges expected for greenfield soils in Dubai.

Please note that the full sets of the soil analysis results from the laboratory are presented in Appendix H.

8.2.4 Groundwater

Groundwater is one of the main conventional water resources (besides desalination) in the UAE alongside seasonal floods and springs. The main aquifers in the UAE include the limestone aquifers in the north and east, fractured ophiolite rocks in the east, gravel aquifers flanking the eastern mountain ranges on the east and west and dune aquifers in the south and west as shown in the Figure 8-4.

Figure 8-4 Main Aquifers in the United Arab Emirates



Source: Article 'Water Resources in the United Arab Emirates', Z. Rizk and A. AlSharhan

The Project site is located approximately 47km from the coastline and falls within the 'Sand Dune Aquifer'. As such it may present relatively shallow aquifer formations. It is anticipated that the density of Ghaf trees within and adjacent to the Project site is affiliated with the availability

of this aquifer (Ghaf tree roots can penetrate to depths of up to 30m to reach groundwater (Source UAE WWF, Conserving-the-tree-of-the-dunes on 1st June 2020).

Groundwater investigation previously undertaken within the boundaries of the Solar Park, in 2015 by ERI Company indicates that there is one groundwater well north of the Solar Park which was confirmed during a site visit in March 2017. At the time of the investigation, the average groundwater level in the general area is about 27m below ground level (mbgl).

This groundwater monitoring well is operated by DEWA and there is no evidence of any groundwater abstraction within the Project area. There are also no identified natural water bodies or channels or evidence of regular surface water runoff in the Project site.

A specific survey to determine baseline conditions and quality of groundwater was scoped out of this assessment due to the depth of previous groundwater records at 27m. Data from a December 2015 geotechnical survey at the DEWA Phase III project (provided with the Phase IV RfP) did not encounter groundwater up to a depth of 10m in any of the 77 boreholes.

8.2.5 Receptors

Table 8-5 Geology, Soil and Groundwater – Receptor Sensitivity

Receptor	Sensitivity	Justification
Local Soil Quality	**Low**	The quality of soil within the Project site is typical of the soil characteristics/structure found in the Emirate and across the UAE. Hence, it is of low or medium importance and rarity on a local scale.
Local Geology	Low	Consolidated gravel plains and unconsolidated dunes are typical soil characteristics of the desert environment; hence the geology within the Project site is of low or medium importance and rarity on a local scale.
Local Groundwater Quality	**High**	Water is a scarce and vital resource with high importance on a national scale and limited potential for substitution. Groundwater resources in the UAE are protected under Federal Law No. 24 of 1999 for Protection and Development of the Environment, Chapter 2, Section 3 Protection of Drinking and Underground Water.

8.3 Potential Impacts

8.3.1 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 the chemical and physical properties of the local soil and potentially groundwater quality.

EARTHWORKS, EXCAVATION OR REMOVAL OF SOILS

The Project will require minor excavation activities to establish foundations for the PV tracker footings. This may likely result in interaction with the site geology which could provide direct pathways for contamination to soils during the construction phase. 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.

The EPC Contractor has advised that there will not be a need to remove soil/surface material from the site and that any cut/fill balance would be managed within the site boundaries.

Direct impacts to groundwater are not expected due to the expected depth of groundwater at approximately 27m depth, far deeper than any foundation and excavation work.

CROSS CONTAMINATION OF SOILS BY SOILS

Elevated concentration of heavy metals or detectable concentrations of TPH were not identified in soils across the Project site from the soil analysis result obtained therefore there is no current contamination of site soils that have been identified.

However, the possibility of encountering some form of contamination due to accidental spills or leaks in areas within the Project site that have been used over time as compacted vehicle tracks cannot be ruled out. If any contamination is present (possibly only in small isolated areas) 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.

ACCIDENTAL LEAKS AND SPILLAGE

Soil quality 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 and result in soil contamination.

It is unlikely that there will be any direct impacts to groundwater quality, although an element of leaching via soils may potentially transfer pollutants.

INADEQUATE WASTE MANAGEMENT

Construction of the proposed project will involve activities that generate solid and hazardous waste, as well as potential liquid wastes. Waste generated during these activities poses a threat to soil quality.

Of particular concern is the management of the relatively small volumes of hazardous waste generated during the construction phase. Although hazardous waste, such as used oil, machinery lubricants and paints is only a small fraction of the total amount of construction waste; it will, however, require special attention during management and disposal (see waste management section for disposal). If the temporary storage and handling of such waste on the construction site are inadequate before being removed for disposal, the risk of contamination to soils and potentially indirect effects to groundwater quality increases. Potential environmental impacts arising from the generation of hazardous wastes are covered in the 'Waste Management' Section of this report.

Table 8-6 Geology, Soils and Groundwater Impact Significance, Mitigation & Management Measures and Residual Impacts- Construction

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
Cross-contamination of Soils	Minor Negative	Local Soil Quality	Low	Negligible to Minor	Training – Contractor staff to be able to identify signs of potential contamination (smell of HC, staining). For any identified contamination, develop and implement a Contaminated Soil Management Plan for appropriate handling, treatment and disposal of soil; to link with the site waste management plan for hazardous constituents. Implementation of good housekeeping practices during construction activities including proper handling, storage (leak/spill prevention and protection – see below), and transport of hazardous materials and waste. Washing of equipment, machinery and vehicles (including any concrete washout) 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. The use of evaporation ponds (e.g. if using concrete washout areas or other ponds) will require the removal of sludge residues as solid hazardous waste by a licensed waste contractor and management as a hazardous waste.	Negligible
Accidental Leaks & Spillage	Minor Negative	Local Soil Quality	Low	Negligible to Minor	Storage of all hazardous materials and chemical on an impermeable base with liners and/or secondary containment with enough capacity to hold 110% of the maximum potential stored volume. Storage of all chemicals/materials according to manufacturer's instructions and MSDSs; MSDSs for all chemicals to be readily available on-site close to storage areas.	Negligible to Minor
	Negligible Negative	Local Groundwater Quality	High	Minor		Negligible to Minor

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
					Use of hazardous items in working areas requires containers/drums/tanks to be stored on spill containment (drip) trays. The project shall develop and implement an Emergency Response Plan (ERP) that includes or is linked to a Spill Response and Contingency Plan. The project shall maintain an inventory of all potentially hazardous materials and chemicals used and stored on-site, including volumes. All spills and leaks to be reported promptly to the Construction Manager and to be investigated to confirm root cause and ensure appropriate corrective and preventative actions. Refuelling and maintenance of vehicles/ equipment shall only be undertaken within a dedicated depot area at the camp, on an impermeable surface with lipped edges to prevent runoff to soils. Well stocked spill kits (i.e. with absorbent materials, PPE and hazardous waste collection provisions) shall be available in specific risk areas of the Project site (e.g. chemical and fuel stores, or areas for refuelling). Relevant personnel (such as HSE staff or environmental staff) to 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 to be maintained and routinely inspected to ensure the tank, pumps, pipework and the vehicle itself are free from leaks and fit for purpose - No equipment will be placed in service until deficiencies are corrected.	

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Potential Impact Significance	Mitigation and Management Measures	Residual Impacts
					Implement a regular maintenance program for vehicles and equipment to minimise leaks or mechanical failures and keep documentary evidence. In use, temporary equipment (containing fuel) to have drip trays to avoid any leaks to the soil surface. Refuelling of and maintenance of vehicles and equipment to take place in designated area.	
Inadequate Waste Management	Minor Negative	Local Soil Quality	Low	Negligible to Minor	All hazardous materials or waste being temporarily used or otherwise stored outside of its designated storage areas should be kept in well-equipped, leak-tight containers with drip protection to avoid leaks to the ground. Wherever possible, the number of chemicals and fuel stored on-site will be kept to the minimum practical level. Infrequently used chemicals should be ordered in suitable quantities only when required. Concrete washout shall only be undertaken at designated and signed areas, with adequate protection to soils, to prevent leaks of the spread of wastewater. Excavated materials will be kept in the stockpiles for as short a time as possible. No hazardous materials are to be stockpiled. The EPC contractor and sub-contractors will provide training relating to the management, transportation and handling of hazardous materials and wastes – in line with any procedures developed to guide the on-site management of such activities.	Negligible to Minor
	Negligible Negative	Local Groundwater Quality	High	Minor		Negligible to Minor

8.3.2 Operational Phase

Project-specific impacts to soils, geology or groundwater are not expected during the operational phase as the site will be static and will not have direct interactions with these environmental parameters. The only potential risks during the operational phase are expected to be limited to the management and storage of hazardous materials such as fuels and chemicals.

ACCIDENTAL LEAKS AND SPILLAGE

During operations, there is expected to be limited potential for impacts to soil or groundwater as a result of accidental spills and leaks.

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 indirect impacts to groundwater.

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

Table 8-7 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	Minor Negative	Local Soil Quality	Low	Negligible to Minor	• The integrity of all storage tanks and bunds to be tested and inspected for leaks and flaws. • Storage of all fuel/chemical or other hazardous liquid/waste tanks shall be on an impermeable base with liners and/or secondary containment with enough capacity to hold 110% of the maximum volume stored. • Where multiple containers are stored, the bund capacity shall be suitable to contain 25% of the volume of all containers. • Operator to develop and implement an Emergency Response Plan (ERP) to include or link to a Spill Response and Contingency Plan. • Personnel in contact with such materials shall be trained on emergency and spill response, containment, material handling and storage procedures. • Availability of suitable containment and spill clean-up materials/equipment at specific locations within the Project site. • Conformance with ERP procedures (preventative and response) will be monitored through routine inspections. • Loss of containment to be reported promptly. This should be investigated to confirm the cause and appropriate corrective/preventative actions put in place.	Negligible to Minor
	Negligible Negative	Local Groundwater Quality	High	Minor		Negligible to Minor

Potential Impacts	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Inadequate sanitary storage and handling	Minor Negative	Local Soil Quality	Low	Negligible to Minor	• Toilet and sanitary facilities to be deployed should be provided with belowground collection tanks of appropriate size depending on the number of personnel to be deployed. • 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 to Minor
	Negligible Negative	Local Groundwater Quality	High	Minor		Negligible to Minor

8.4 Monitoring

Table 8-8 Geology, Soils and Groundwater- Monitoring Requirements

Monitoring	Parameter	Frequency & Duration	Location	Responsibility
Construction & Operation				
Soil Quality	Hydrocarbons and other potentially hazardous or chemical pollution sources, as well as septic tanks (for leaks and overflow)	Daily visual inspection	The entire Project area during construction and operation	EPC Environmental Manager and O&M Environmental Manager

9 WASTE AND WASTEWATER MANAGEMENT

This chapter assesses the projects expected generation of waste and wastewater at the construction and operational phases. It does not consider the significance of impacts concerning a specific receptor (i.e. soil or groundwater quality); as such impacts to soil or groundwater quality concerning waste and wastewater have been assessed in the respective section of this ESIA (Section 8 Geology, Soil and Groundwater).

The primary purpose of this chapter is to identify specific management measures regarding waste and wastewater generation that can be adopted in the construction and operational phases ESMS' to ensure compliance with applicable regulations and standards.

9.1 Standards and Regulations

9.1.1 Local and Federal Requirements

The Project is required to comply with the following Dubai Municipality standards for the prevention of land contamination:

- DM-ED established principle controls for waste legislation through Administrative Order No. (30)/2003 in conformity with the Local Order No.11/2003 Concerning Public Health and Community Safety in the Emirate of Dubai and associated Waste Management Technical Guideline 1;
- Dubai Municipality Environmental Standards and Allowable Limits of Pollutants on Land, Water and Air Environment (May 2003) and;
- DM-ED Environmental Clearance March 02, 2020, the EC (EPBI-170220-00226 for the 5,013MW Photovoltaic (PV) and Concentrated Solar Power (CSP) Mohammed Bin Rashid Al Maktoum Solar Park.

9.1.2 Lender Requirements

Equator Principles Financial Institutions providing project finance will require adherence with the WBG General EHS Guidelines. Concerning 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 generated 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.

9.2 Potential Impacts

9.2.1 Construction Phase

The construction phase can often be the most environmentally damaging phase of a project, particularly regarding the volumes of waste that are generated, if not properly managed.

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, a key waste stream will be the packaging of the PV modules. This includes loads of wooden pallets, cardboard, plastic ties and some metal frames.

The 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.
  - Broken PV Panels

Given the project footprint, the amount of solid waste generated will be of 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.

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 to reduce associated secondary impacts such as unnecessary resource use, dust emissions, etc.

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, and groundwater section 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 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.

The majority of the non-hazardous solid wastes generated onsite will be recycled and reused to reduce the quantity of waste to be disposed at landfill sites to as low as practicable.

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
- Stormwater 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 (approximately 1,000) who will generate an amount of wastewater. Such wastewater will be stored within septic tanks on-site, before

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.

Stormwater is not expected to occur regularly due to the climatic condition of the UAE. However, when rainfall occurs, stormwater 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/wadi channels and reaching the groundwater.

SUMMARY OF EXPECTED WASTE & WASTEWATER

Waste streams likely to be associated with the construction phase of the project and their expected quantities are listed in the table below.

Table 9-1 Anticipated Waste Types and quantities expected during Construction

TYPE	FROM	QUANTITY	CLASSIFICATION
Metal	Packing metal Material	100 tonne	Non-Hazardous
	Welding rods	1 tonne	
	Welding slag		
	Off-cuts		
	Wire Slings		
	Equipment Maintance Parts		
Cardboard and Paper	Camp and Catering supplies	100kg/day	Non-Hazardous
	Office matrerials	1m^3	
	Newspapers and Cartons		
Glass	Broken windows, Mirrors, glasses	0.1m^3	Non-Hazardous
	Empty Glass Bottels		
Concrete	Residual content in concrete delivery trucs	1 tonne	Non-Hazardous
	Surrplus amounts of completeions of concrete pours		
	Chipping and removing poured concrete		
Sewage	Treated Effluent	10m^3/day	Non-Hazardous
Oily Waste	Oil Filters	200pcs	Hazardous
	Oil Changes	3800 l/time	
	Leakages and spill absorbent material	1m^3/day	

TYPE	FROM	QUANTITY	CLASSIFICATION
Medical Waste	Syringes and other sharp objects	5pcs/month	Hazardous
	Blood stained swabs, bandages and plasters	1m^3/month	
Chemical	Painting and coating material	1000L	Hazardous
	Cleaning agents and solvents	10 bottles	
	Sewage Treatment Plant chemicals	2 bottles	
PV Modules*	Broken panels from construction and delivery	30pcs	Hazardous
Other	Redundant Batteries	100pcs	Hazardous
	Composite of acid, metal and plastics	0.1m^3	
	Aerosol paint tins and contaoners	0.1m^3	

**There are not expected to be broken panels as result of construction. Where the panels are delivered damaged, these will be issued back to the OEM. The number of 30 modules has been provided as an indicative number by the EPC contractor, with relate to damaged once they have been received on site.*

9.2.2 Operational Phase

The operational phase of the 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.

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 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.
- Broken PV panels

Inappropriate handling of hazardous waste streams through lack of personnel training on-site may lead to the accidental release of hazardous waste, contaminated 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
- Stormwater runoff (from hard standing areas of the 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 drain 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 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 and Groundwater' section of this report.

Stormwater has the potential to runoff to areas both on and off-site, potentially contaminating soil (if carrying pollutants) and possibly reaching groundwater resources. However, heavy rainfall is rare and only a small number of rainy days per year occur in the UAE.

9.3 Mitigation and Management Measures

9.3.1 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 this Project, waste has been classified into four (4) main categories below.

Table 9-2 Waste Characterization

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 before 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. Under DM guidelines and the Basel Convention, hazardous waste is as 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 of by an approved waste services provider.

Waste Classification	Description
Medical Waste	Type of hazardous waste for which classification and disposal requirements are defined in the document the UAE Regulation for 'Handling of Hazardous Substances, Hazardous Wastes and Medical Wastes', under Ministerial Decree No. 37 of 2001

9.3.2 Waste Management Hierarchy

The waste hierarchy illustrates good 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 9-1Waste Hierarchy

Source: United Nations Environment Programme

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.

Such an approach is also used in other areas of the world. US-EPA's Waste Minimisation Program presents the following objectives:

- Complete elimination of, or substitution for priority chemicals, wherever possible;
- Minimising the number of priority chemicals used whenever elimination or substitution is not possible;
- Maximising recycling whenever elimination, substitution, or minimisation is not possible, creating closed-loop materials management systems that eliminate or constrict release pathways;
- Promoting cradle-to-cradle waste management instead of cradle-to-grave waste management

9.3.3 Construction Phase

Table 9-3 Waste & Wastewater Mitigation and Management Measures - Construction

IMPACT/SOURCE	MITIGATION AND MANAGEMENT MEASURES
Inappropriate handling, storage, transport and disposal of solid non-hazardous waste	• The project shall 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. • 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 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 to prevent pests from 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 only be transported off-site for disposal by an appropriately licensed waste contractor. • Only licensed waste transporters and waste management facilities will be engaged.

IMPACT/SOURCE	MITIGATION AND MANAGEMENT MEASURES
	• 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. • Mandatory training program for employees to increase their awareness of waste management protocols including proper handling and storage of waste, and emergency response and contingency plans.
Inappropriate/un controlled handling, storage, transport and/or disposal of solid hazardous waste including broken PV Panels	• 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 signed and labelled waste containers/skips. • 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. • The hazardous waste storage area should be constructed away from the drainage system. A rain shelter will also be provided to avoid any potential instance of runoff or leakage of runoff. • Waste containers should be 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. Wherever possible, chemicals will be kept in their original container. • Keep hazardous waste storage areas away from any ignition sources or fire hazards. • Disposal of hazardous waste to the desert is strictly prohibited. • Where the PV panels are delivered damaged, these will be issued back to the OEM
Inappropriate/un controlled handling, storage, transport and/or disposal of sanitary wastewater	• Contractor to develop and implement a Project Specific Construction Waste Management Plan (CWMP) following 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 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 per spill containment procedures and clean up procedures (to be developed in line with the CESMP). • Engage a DM approved waste contractor for the periodic removal of the tanks.

IMPACT/SOURCE	MITIGATION AND MANAGEMENT MEASURES
	• Sanitary wastewater tanks should be placed in allocated impervious hard standing areas with bonding capacity to hold 110% volume of the maximum volume stored. • In common with the IFC EHS Guidelines, an 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.
Inappropriate handling and disposal of contaminated soil from clearing and excavation works causing cross-contamination of soils	• In-situ testing of soil to ensure it is not contaminated and can be reused or disposed of into land. • Training –Contractor staff to be able to identify signs of potential contamination (smell of HC, staining). • If contamination is found, develop and implement a Contaminated Soil Management Plan for appropriate handling, treatment and disposal of soil
Medical Waste	• Any generated medical waste (i.e. form on-site clinics) shall be stored in appropriate medical waste containers. • All medical waste shall only be handled by trained personnel. • Removal of any medical waste from the site for appropriate treatment, disposal/incineration shall only be conducted by a licensed contractor.

9.3.4 Operations Phase

Table 9-4 Waste & Wastewater Mitigation and Management Measures- Operations

SOURCE	MITIGATION AND MANAGEMENT MEASURES
Inappropriate handling, storage, transport and disposal of non-hazardous solid waste	• Contractor to develop and implement a Project-specific Operations Waste Management Plan (OWMP) in line with committed mitigation measures in this ESIA report and the provisions of the OESMP. • 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 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, to prevent pests from gaining access. • 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. • Paper cardboard, metal cans, plastic, glass to be collected for recycling by a DM approved waste contractor. • Waste generated during construction will only be transported off-site for disposal by an appropriately licensed waste contractor.

SOURCE	MITIGATION AND MANAGEMENT MEASURES
	• 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	• 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. • Engage a DM approved waste contractor for the periodic removal of the tank. • Sanitary wastewater tanks in allocated impervious hard standing areas with a bunding capacity of 110% volume of the maximum volume stored.
Inappropriate/uncontrolled handling, storage, transport and/or disposal of solid hazardous waste including broken PV Panels	• 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 signed and labelled. • Store hazardous waste(including broken PV panels) 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 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. Wherever possible, chemicals will be kept in their original container. • Broken PV panels will be shipped to either the OEM or an authorised company for recycling.

10 ARCHAEOLOGY AND CULTURAL HERITAGE

10.1 Standards and Regulations

10.1.1 National Regulations

There is currently no UAE federal or Dubai local legislation for the protection of archaeological sites, antiquities or fossils. However, the Cabinet of Ministers approved a draft federal law for the protection of antiquities in 2014, which was also passed by the members of the Federal National Council (FNC) in May 2015. This law will regulate the protection of archaeological sites in the UAE, starting with the establishment of a federal and local registry. The registry will identify, classify, preserve and safeguard antiquities as well as prohibit their import and export without a licence from the competent authority.

The Convention Concerning the Protection of World Cultural and Natural Heritage (1972) was accepted by the UAE in 2001, however, it has not been signed or ratified.

10.1.2 Lender Requirements

EPFIs will require adherence to IFC Performance Standard 8, which requires the identification and protection of features of cultural heritage value and *'recognizes the importance of cultural heritage for current and future generation and aims to ensure that clients protect cultural heritage in the course of their project activities'*.

10.2 Observations and Baseline Conditions

10.2.1 Archaeological Sites in the UAE

According to the UAE Ministry of Culture and Knowledge Development, the geographical location of the United Arab Emirates positioned it as one of the major trade destinations and commercial passage linking the three old continents (Africa, Asia and Europe) throughout the ages. This attracted many civilisations to the area that in turn marked it with historical landmarks and remains that have shaped the history of the country. Archaeological excavations in the UAE began in the 1950s with the first archaeological discoveries made in the Emirate of Abu Dhabi during oil exploitations of the Trucial States era. In 1958, a settlement from the second half of the 3rd millennium BC was discovered on Umm Al Nar, a small island offshore Abu Dhabi Island. Over time, many more archaeological discoveries from the Bronze Ages until the Islamic Period (including tombs and settlements) were made which extends human habitation and cultural heritage in UAE back to 3,000 years or more. Some of the archaeological discoveries include but not limited to the following:

- Jabel Hafit Tombs (Bronze Age 300 – 2700 B.C.) – Al Ain
- Umm AL Nar (Middle Bronze Age 2700 – 2000 B.C.)- Umm Al Nar

- Al Hilli Archaeological Park (Middle Bronze Age 2700-2000 B.C.) – Al Ain
- Al Qusais (Iron Age 1300-300 B.C.)- Al Qusais
- Jumeirah (the early Islamic era Abbasid 750 A.D - 1258 A.D) – Dubai
- Alamuehat Site (Bronze Age 2700 – 2000 B.C.) – Ajman
- Qidfa site (Iron Age / 1300 -300 B.C)- Fujairah
- Shaml (Bronze Age / 2000 -1300 BC)- Ras Al Khaimah

The cultural sites of Al Ain (Hafit, Hili, Bidaa Bint Saud and Oases Areas) has been inscribed on the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage List which constitutes a serial property that testifies the sedentary human occupation of the desert region since the Neolithic period with vestiges of many prehistoric cultures.

One of the most significant archaeological sites within Dubai is the Saruq Al-Hadid site, which was discovered by chance in 2002 by His Highness Sheik Mohammed bin Rashid Al Maktoum Vice-President, and Prime Minister of the United Arab Emirates and Ruler of Dubai. The site is located in desert landscape in southern Dubai, on the northern edge of the great Rub al- Khali desert and near the border with Abu Dhabi covering an area of approximately 6.2km^2.

It is believed that only 10 to 15% have been excavated so far. Evidence of over five thousand years of activity has been found including working of copper alloys, gold and iron. These discoveries provide ample evidence that the Emirate did not become a centre of trade only in the 21st century or after the development of the Dubai Creek but had strong trade links with a lot of the ancient world; from Egypt to the Indian subcontinent. Iron is particularly significant because evidence of iron working from this period is rarely found in the Arabian Peninsula. It is, therefore, one of the most important Iron Age sites in the Arabian Peninsula dated around 3000 years ago, when the site was a centre for metalworking on an industrial scale. Over ten thousand artefacts have already been recorded until 2015.

10.2.2 Cultural Heritage in the UAE

The heritage of the UAE is rich in oral literature, folklore, customs and beliefs, traditional handicrafts, games and sports, as well as performing arts. The UAE is historically known for its attachment to camels, which were a dependable source of not only transport but also food and milk. With time, the camel was transformed from being only an instrument of transport and migration to an important pillar, a significant feature in heritage and traditional Arab character. Built on this belief and in appreciation for the precious heritage of the past, the late Sheikh Zayed bin Sultan Al Nahyan promoted camel farming and encouraged the practice of camel racing or sibaqat al hejin, which are therefore considered important traditions of the UAE that need to be preserved.

10.2.3 Project Site

The proposed Project site is relatively large (i.e. 10.2km^2) and is characterised by sand sheets and dunes as well as gravel plains. During the site visits undertaken to-date, no features of cultural value or evidence suggesting the presence of archaeological features were identified within the project footprint. No archaeological sites within or nearby the Project site have been referenced in publicly held data such as the National Council of Tourism and Antiquities website and the Proceedings of the First International Conference of Archaeology in the UAE.

However, the Project site is believed to be located less than 25km away from the Saruq Al-Hadid archaeological site in a similar undisturbed desert environment. Therefore, the possibility of finding unknown underground archaeological artefacts or remains of cultural conservation value during site clearance and earthworks cannot then be ruled out.

As previously mentioned in Section 2.2.3 "Site Conditions and Local Context", there is evidence that small sections of the surrounding area are currently being used for camel farming. As an important pillar and a significant feature in heritage and traditional Arab culture, the camel farms can be said to be of cultural conservation significance and are hence classified as receptors.

10.3 Receptors

Table 10-1 Archaeology and Cultural Heritage – Receptors sensitivity

RECEPTOR	SENSITIVITY	JUSTIFICATION
Unknown belowground archaeological artefacts or remains	High	Although 25km away from Saruq Al-Hadid archaeological site, unknown archaeological artefacts or remains that could be of high importance and rarity on a national scale could potentially be present belowground within the Project site.
Camel Farms	High	Camel farming and herding are recognised as an important aspect of the UAE heritage and are considered of conservation value. Hence this receptor is of high importance and rarity on a national scale with limited potential for substitution.

10.4 Potential Impacts

10.4.1 Construction Phase

There is always the potential of encountering unknown buried archaeological remains or artefacts during excavation and earthwork activities. This could lead to damage, destruction and loss of archaeological artefacts of conservation value. Given the absence of other known cultural heritage features in this area and lack of evidence of previous land use, the presence of archaeology within the project footprint is unlikely.

A chance finds procedure shall, however, be incorporated within the project CESMP such that in the unlikely event any items of archaeological significance are discovered, these can be appropriately identified and preserved.

The development of the Project will not represent a loss of the camel farms identified in the surrounding area.

10.4.2 Operational Phase

The operational phase will not result in further impacts to archaeology, as the site will be static and excavations will not be required.

Table 10-2 Archaeology and 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 destruction of unknown archaeological resources buried within the Project site.	Minor Negative	Unknown belowground archaeological artefacts or remains	High	Minor to Moderate	• A chance finds procedure will be developed during construction as part of the CESMP. This will include protocols to stop works and methods preserve potential finds, as well as reporting requirements and co-ordination with DM-Architectural Heritage & Antiquities • Where artefacts or archaeological remains are encountered, the site shall be signed/delineated with high visibility flagging to impede access and prevent any damage or loss of removable objects. • Contractor crew to be informed during morning toolbox meeting about any suspected archaeological finds to avoid disturbance. • Removal of any archaeological artefacts from the site by site workers is strictly prohibited.	Minor

Table 10-3 Archaeology and Cultural Heritage - Monitoring Requirements

Monitoring	Parameter	Frequency & Duration	Location	Responsibility
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 during construction and operation	Site staff and coordinated by EPC- Environmental Manager

11 LANDSCAPE AND VISUAL AMENITY

Specific legislation regarding landscape and visual impacts does not exist in Dubai or the UAE however assessment has been guided by the UK Landscape Institute 'Guidelines for Landscape and Visual Impact Assessment. As such, The 'Landscape and Visual Assessment' assessment presented herein will distinguish between:

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

IFC Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources considers direct and indirect project-related impacts on biodiversity and ecosystem services but also takes into account the different values attached to biodiversity and ecosystem services by Affected Communities such as the landscape.

11.1 Observations and Baseline Conditions

11.1.1 Landscape

The proposed project will be constructed on a predominantly undeveloped, open landscape. Landscape typology is characterised by a belt of flat plains of sand and gravel and an undulating dune landscape with small linear dune ridges. The site presents sparse vegetation of low shrubs and sporadic Ghaf trees visible along dune ridges, corresponding to the typical desert character of the UAE.

The only observable anthropogenic contributions to the landscape are from the existing PV and CSP projects, substation and overhead power line to the north and other active construction sites within the park. There is also a telecommunications tower closer to the site, but outside of the solar park in this area. The existing PV solar power plants have resulted in a more industrial feel to the landscape and have notably resulted in a change of colouration when viewed from above, due to the dark colour panels above the golden yellow sand. The on-going construction for the Phase IV site will result in a more mirror-like reflection of the sky once the parabolic troughs and heliostats are fully installed.

11.1.2 Visual Amenity

When establishing the value of views and visual amenity, the inter-relations between individuals or groups of people and landscape shall be considered such as the change of views that people have of the landscape and the effects of change on their visual amenity. The Visual baseline has therefore been established by:

- Identifying views, viewpoints and extent of possible visibility;
- Identifying people who may be affected.

Besides the existing facilities within the park, views across the site are predominantly unobstructed and provide a good example of desert typology found within the UAE.

With regards to visual receptors, the site surveys and satellite imagery identified no evidence of permanent dwellings within 1km of the project boundary, with a few out of this range.

Within the Solar Park, two (2) camel farm was identified east of the Project site, approximately 2.8km and 8km respectively. Outside the Solar Park, visual receptors are multiple kilometres away from the Project boundary and have no direct visibility of the proposed solar fields.

The potential landscape & visual receptors are presented in the table below.

Table 11-1 Potential Landscape & Visual Amenity Receptors

RECEPTOR	RECEPTOR TYPE AND LOCATION	SENSITIVITY	JUSTIFICATION
Landscape Character of Project site	Open Greenfield- Across the entire Project site	**Low**	The landscape across the entire Project site is that of the typical desert landscape present across the UAE. It is therefore of low or medium importance and rarity on a local scale.
Camel Farms	Agricultural (Approximately 2.8km and 8km respectively)	**High**	Camel farming and herding are recognised as an important aspect of UAE heritage. This receptor is of high importance and rarity on a national scale with limited potential for substitution. And it's presence within the Project site makes it particularly vulnerable to changes in landscape character.

11.2 Potential Impacts

11.2.1 Construction Phase

LANDSCAPE CHARACTER

The construction of new development, particularly those on a large scale such as the Phase V PV project have the potential to result in changes to the landscape character of a locality through land use and topographical changes. One of the first stages of construction activities will result in the fencing, levelling, grading and preparation of the site, ahead of construction beginning and the movement of construction vehicles to and from the project site, these will include trailers, cement trucks, graders, excavators, loaders, water trucks, waste removal truck, etc. The proliferation of other activities throughout the construction period and across the site will eventually result in major land-use changes, which will take place steadily over the construction phase.

The landscape of the entire MBR Solar Park is already changing from an open gravel plain and dune habitat to an industrialised landscape character due to the development of previous phases of the Solar Park Project. The development of this Phase V PV project will further this transition with the subsequent construction of similar structures and facilities, but will not have the large vertical landscape intrusions such as the Phase IV Tower.

VISUAL AMENITY

The movement of heavy construction vehicles and earthworks on sandy surfaces are likely to result in dust generation beyond the Project boundary 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 this area that has previously been free of any light sources. The use of lighting across the site will result in a nighttime light haze likely to be visible for several kilometres from the project area (it is worth noting that there is already night time lighting installed at the currently operational plants in the solar park, which is primarily limited to working areas only, as well as roads).

Table 11-2 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	Moderate Negative	Landscape character of the entire Project site	Low	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.	Minor
Disturbance to Visual Envelope of Receptors	Minor Negative	Camel Farm	High	Minor to Moderate	• Where appropriate, construction laydowns and working areas of the site shall be screened to reduce the visual intrusion to existing off-site receptors. • When not in use, cranes and other construction plants shall be lowered, so they are at their minimum height and do not protrude unnecessarily within the visual envelope of local receptors. • Mitigation and management measures relating to the generation of dust (as detailed in Section 5 Air Quality) shall be implemented to minimise visual impacts during construction activities. • Minimise construction works at night-time to those strictly required. • Any floodlights required during night time construction activities will be directed onto the working areas, with a maximum position angle of 30° from vertical, and back spill shields, therefore minimising any unwanted light spill.	Minor

11.2.2 Operational Phase

LANDSCAPE CHARACTER

The development of the Project will include the installation of thousands of PV panels, the construction of substations, administrative facilities, etc. (ref. Project Description), which will distort the existing undeveloped landscape character. The view of the characteristic majestic dunes and gravel plains will be replaced with dark coloured PV panels covering an expansive area. The extent of the area to suffer the change of landscape character will be limited to the Project footprint but can be viewed from off-site areas.

Given the lack of and 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.

The Project's PPA is for 25-years. Although into the future, if the solar plant were to be decommissioned after 25-years of operation, the associated effects of the operation of the plant on the landscape character could be reversible as the site could be returned to its original condition; based on the assumption that dunes would reform and vegetation would re-grow.

VISUAL AMENITY

Following the impacts of construction and the establishment of Project facilities, the operational phase will not result in changes to the visual envelope of receptors overlooking the Project site. Although lighting impacts will occur at night, it is envisaged that only minimal lighting will be required 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 during the construction phase.

Table 11-3 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	Moderate Negative	Landscape character of the entire Project site	Low	Minor	• Lighting provision shall not be excessive or unnecessary and not result in a 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 of the site.	Minor
Disturbance to Visual Envelope of Receptors	Minor Negative	Camel Farms	High	Minor to Moderate		Minor

12 SOCIO-ECONOMICS

12.1 Standards and Regulations

There are no UAE federal or Dubai local legislation or guidelines that regulate the socio-economic aspects of development projects.

EPFIs require adherence to IFC Performance Standard 1 on Assessment and Management of Environmental and Social Risks and Impacts. This standard requires that the process of environmental impact also considers social aspects and involves engagement between the Client, its workers, local communities directly affected by the project (the Affected Communities) and, where appropriate, other stakeholders.

12.2 Observations and Baseline Conditions

12.2.1 Population and Demographics

According to the Dubai Statistics Center (DSC), the resident population of Dubai was estimated in 2016 to stand at 2,698,600 individuals. Of these, 1,888,520 were males and 810,080 females, representing approximately 70% and 30% respectively of the total population. The higher proportion of males to females is attributed to the large expatriate working population, a majority of which are males who are not accompanying their family members.

There is a slight discrepancy between the UAE population estimated by the World Bank being 9,269,612 million (2016), the one estimated by the UAE Federal Competitiveness and Statistics Authority (FCSA) being 9,121,167 million (2016) which has been sourced from the UN Population Division and a great discrepancy between the above mentioned and the CIA World Fact Book 2017 estimate of 6, 072, 475 million.

In comparison with the FCSA estimated wider UAE population of approximately 9,121,167, Dubai represents approximately 30% of the national population, forming the largest urban area. Native Emiratis comprise approximately 9% of the Dubai population and approximately 11% of the wider UAE population.

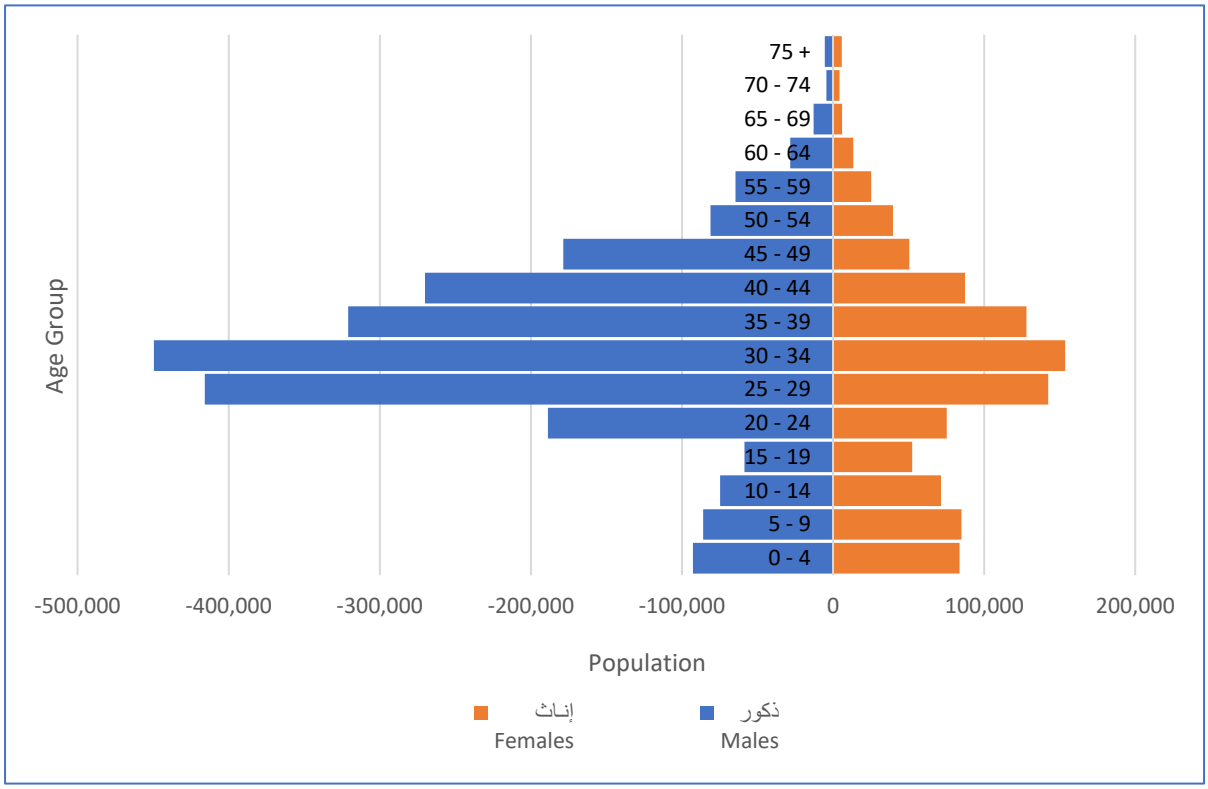
Looking beyond the resident population, a total of approximately 3.8 million individuals are understood to be active in Dubai on an average day. This includes residents, those in employment in Dubai and residing outside the Emirate, and an average of the number of businessmen, tourists, sailors, and those transiting the Emirate (excluding those who do not enter UAE territory). A large portion of this figure arises due to the cost differential between accommodation in Dubai and the Emirates to its north (Sharjah, Ajman, Ras Al Khaimah etc.).

Table 12-1 Dubai Population Data Summary

CRITERIA	DATA (2019 ESTIMATE UNLESS SPECIFIED)
Population	3,355,900
Age Structure	0-14 years: 14.71% 15-24 years: 11.17% 25-54 years: 69.05% 55-74 years: 4.74% 75 years and over: 0.33%
Sex Ratio (Male/ Female)	0-14years: 1.06 15-24 years: 1.93 25-54 years: 2.85 55-74 years: 2.25 75+years: 0.93 Total population 2.28 male/ female

Source: https://www.dsc.gov.ae/en-us. **Accessed 2nd June 2020**

Figure 12-1 Dubai Population Pyramid



Source: https://www.dsc.gov.ae/en-us. Accessed 2nd June 2020

12.2.2 Economy & Employment

The UAE has an open economy with a high per capita income and a sizable annual trade surplus. Official figures from 2017 place the Gross Domestic Product of Dubai at approximately AED 378.7 billion. National GDP growth rate for 2017 was estimated at 0.8 %.

As of 2015, approximately 80% of the Emirate's resident population of working age is judged to be economically active, with the remaining percentage largely comprised of students/youths, housewives, elderly and a small percentage classed as unable to work. Official unemployment in the Emirate (2016) is calculated to be 1.6%. These figures largely represent the native population, with the link between residency and employment suppressing the overall level of unemployment by removing those out of work out of the resident population.

Official inflation figures for 2015 place the level of general annual Inflation rate at 3.99%, with a major influencing factor being a decline in the cost of the "Housing, water, electricity, gas and other fuels" category (7%) and "Furnishings, household equipment and routine household maintenance" (7.64%), which carry the highest weighting in the inflation calculations.

Table 12-2 Summary of UAE Economic Data

CRITERIA	DATA (2017 ESTIMATE)
GDP (Purchasing Power Parity)	US$ 696.0 billion
GDP (Official Exchange Rate)	US$ 382.6 billion
GDP (Real Growth Rate)	0.8%
GDP per Capita	US$ 68,600
Industrial Production Growth Rate	1.8%
Labour Force	5.344 million
Unemployment Rate	1.6% (2016 est.)

Source: https://www.cia.gov/library/publications/the-world-factbook/geos/ae.html. Accessed 2nd June 2020

12.2.3 Social Development & Infrastructure

Using the United Nations Human Development Index as a guide, the UAE as a whole raked 42, with an index score of 0.840 (2016). This compares favourably with the regional average (0.652) and places the UAE within the global top of 50 at an overall level. Within the key indicator areas of Health & Education, the UAE index ranks as "High" and "Medium" respectively.

12.2.4 Local Population Data

The project site is located directly in a desert area, known as Saih Al Dahal. The area is very remote and there is little development in the local area.

Population statistics from the DM Population Bulletin 2016 indicate that Saih Al Dahal has a residential population of five (5). The population of the surrounding local areas concerning the proposed development site are in Table 12-3 and have been extracted from the Dubai Municipality 'Population Bulletin, Emirate of Dubai, 2016'.

Table 12-3 Local Area Population Statistics

COMMUNITY NAME	COMMUNITY CODE	POPULATION
Al Fagaa	945	370
Saih Al Salam	951	765
Al Hathmah	956	-
Ghadeer Barashy	967	10
Saih Al Dalah	**971**	**5**
Al O'Shoosh	975	-
Mugatrah	981	100
Hefair	991	-
Total		**1250**

Source: DM, Dubai Population Bulletin No. of Estimated Population by Sector and Community, Emirate of Dubai, 2016

Among these areas, there are several local services, which are built commensurate for the population of the local areas. These include mosques and shops as well as the Al Qudra lakes and Al Qudra cycle track which are recreational areas.

12.2.5 Agriculture Land Use

The majority of land within the Project site is in natural condition. Apart from grazing across the site by Gazelles, Arabian Oryx and Camels, no agricultural related activity or settlements were identified within the Project site.

12.2.6 Commercial and Industrial

Other than the existing PV and CSP plants as well as other solar park facilities currently under construction, there no other commercial or Industrial facilities within the Project boundary.

12.2.7 Traffic and Transportation

Transport to the solar park is available via a paved road named Majlis Road which joins with an unnamed arterial route approximately 9km to the north of the Solar Park boundary. Residents of the Settlement Communities and commercial establishments in the area use the unnamed arterial route. Majlis road does not provide a through route to any known residential areas. Therefore, use is only anticipated to be from users of the Falcon Majlis, a small settlement with mosque and the Solar Park.

12.3 Receptors

Table 12-4 Potential Socio-Economic Receptors

RECEPTOR	SENSITIVITY	JUSTIFICATION
The welfare of Local Population	**High**	Any change to infrastructure, population or regional inputs is likely to have a knock-on effect for the welfare of the local population.
Local / Regional Economy	**Low**	The proposed project is likely to influence regional businesses. Not only local contractors and those directly involved in the construction but also for local commercial operations such as accommodation, food retailers etc.
Employment Market	**Low**	The structure of the labour market in the UAE provides a relatively flexible labour supply coupled with low rates of unemployment. Therefore, the employment market is not susceptible to major changes arising from the Project.
Users of Majlis Road	**Low**	Based on observations during the site visits, the road does not present frequent traffic since it services a low populated area. The receptor is therefore not significantly impacted and shows a large spare carrying capacity

12.4 Potential Impacts

12.4.1 Construction Phase

EMPLOYMENT & ECONOMICS

The primary economic impact during construction is likely to result from employment creation during this phase. 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.

Notwithstanding the above, our experience of similar sites within the UAE suggests that a lack of available construction workforce among the immediate local population makes it probable that a large proportion of work on the site will be undertaken by expatriate workers. This could result in the repatriation of wages and a reduction in the benefit to the local economy of wage expenditure.

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.

Given the nature of the development and specialised nature of required materials, additional impact on the local economy is likely to arise from the procurement of specialised kind of materials internationally.

TRAFFIC AND TRANSPORTATION

The construction period will cause an increase in vehicles entering the Solar Park. Construction vehicles will include a variety of vehicle classifications, e.g. HGV's, LDV's, trucks, pick-up trucks, excavators and other heavy/light equipment. It is envisaged that the Majlis which is connected to the unnamed arterial route road will be used as the main entrance to the Project site.

Traffic flow on the Majlis road is not anticipated to significantly increase during construction, as stated in section 2.8.2, the expected daily averages for vehicles during the peak construction phase are not expected to be more than 60 vehicles per day.

As the increase in traffic will only be temporary and will be spread out throughout the day, anticipated impacts on road users (e.g using Falcon Majlis, Solar Park access roads, and roads to Al Qudra Lakes etc.) is considered minimal and will unlikely result in a noticeable.

Even though the impacts are expected to be minimal, the EPC contractor has advised that they will develop a Traffic Management Plan (EPC Doc' ref': SE3-00-LG-SEC-PLN-000(G)-000001) to be implemented alongside the CEMP.

Table 12-5 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	Low	Negligible to Minor Positive	• The contractor should seek to employ locally available workers where possible. • The EPC and Sub-Contractors HR Policy will be prepared to ensure consistency in line 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.	Negligible to Minor Positive
Training and dissemination of construction skills	Minor Positive	The welfare of Local Population	High	Minor to Moderate 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 regarding 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.	Minor to Moderate Positive
Purchase of construction materially locally	Minor Positive	Local / Regional Economy	Low	Negligible to Minor Positive	• Contractor to purchase goods and materials from the local/regional economy where possible	Negligible to Minor Positive

Potential Impact	Magnitude of Impact	Receptor	Sensitivity	Impact Significance	Mitigation and Management Measures	Residual Impacts
Increase in traffic	Minor Negative	Users of Majlis Road	Low	Negligible to Minor Negative	• Construction access roads to be signalized. • Minimise the number of construction road movements as much as practicable, maximising 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

12.4.2 Operational Phase

The completion of the proposed project will result in the secure provision and increased capacity of electrical energy to the population of Dubai and will reduce Dubai's dependency on fossil fuel-generated power, as well as reduce atmospheric pollution; in comparison to other power generation technologies in the current Dubai energy mix.

As such this will align with the Dubai Integrated Energy Strategy 2050 to diversify the energy mix and increase renewable power generation; a key element towards the Paris Agreement. Furthermore, the operation of the PV Plant will create employment and training opportunities for UAE nationals and facilitate the development of local capabilities and expertise and the dissemination of skills in renewable energy.

TRAFFIC AND TRANSPORTATION

The operational phase of the project will include a limited number of vehicle movements, linked to staff, Nitrogen supplier trucks, waste disposal contractor and the occasional delivery to site (See Table 2-7). As per the O&M staffing plan outlined in the project description, there are expected to only have a maximum of 8 staff on-site at any time, mainly due to the remote operation of the plant from NOMAC HQ in Dubai. Consequently, there will be a limited number of vehicles travelling to the site for the day to day activities.

Despite the low number of vehicles, NOMAC's HSE Management Systems Structures for projects requires the development of a "Vehicles Control On & Off-site" procedure. This will include delineation of key routes on-site access locations, waiting areas and security requirements for vehicle access.

Table 12-6 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
A sustainable supply of renewable energy	Moderate Positive	Dubai Electricity and Water Authority (DEWA)	High	Moderate to Major Positive	• Ensure the appropriate operation and maintenance of the solar plant facilities to enable a secure supply of renewable energy	Moderate to Major Positive
Employment Opportunities, facilitating development and dissemination of skills to UAE Nationals	Minor Positive	Employment Market	Low	Negligible to Minor Positive	• Employment of UAE nationals where possible. • Training plans to be developed and implemented to facilitate career development and advancement within the local workforce.	Negligible to Minor Positive
Increase in traffic	Minor Negative	Users of Majlis Road	Low	Negligible to Minor Negative	• Access roads to be signalized. • Minimise the number of road movements as much as practicable. 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.	Negligible to Minor Negative

12.4.3 Monitoring

Specific monitoring metrics are not proposed for socio-economics.

13 CLIMATE AFFAIRS

13.1 Overview

Significant amounts of scientific research have identified a link between the rising concentration of greenhouse gases in the atmosphere and trends in current global warming. A key factor in the increases of GHGs would result from the combustion of fossil fuels and the associated release of GHGs into the atmosphere. Potential impacts of global warming have been modelled by various agencies and organisations and are now well documented. Besides a global average rise in temperature, there is expected to be rising sea levels, more frequent extreme weather events, as well as associated impacts to biodiversity, amongst many other primarily negative impacts.

Such impacts of current climate change are starting to be realised worldwide, and will likely include impacts to the UAE. The impacts on climate due to the proposed project activities and associated facilities are discussed in this chapter, as is a high-level vulnerability overview of potential climate impacts on the Project.

13.2 Standards and Regulations

13.2.1 National Context and Regulations

The UAE ratified the Paris Climate Agreement from the 21st Conference of Parties (COP 21) in September 2016. In June 2017, the UAE's Ministry of Climate Change & Environment (MOCCAE) released the 'National Climate Change Plan of the United Arab Emirates' covering the period 2017 – 2050. The plan is designed as a framework for all mitigation and adaptation efforts across the country as well as setting mandates reflected in the UAE Vision 2021 and the UAE Green Agenda 2015 - 2030 (MOCCAE, 2017). The plan sets out a process to establish a national GHG emissions management system by 2020, to develop a national adaptation plan, and to diversify the UAE's private sector.

To date, specific standards or regulations have not been brought in concerning Projects and climate change in Dubai. However, climate-related considerations are required (where applicable) as part of the established project permitting processes for EIA in Dubai (to enable Environmental Clearance for certain categories of projects).

13.2.2 Lender Requirements

Equator Principles IV establishes that impacts to climate should be avoided where possible, and in support of the 2015 Paris Agreement recognises that EPFIs have a role to play in improving the availability of climate-related information.

Factors including climate change are required to be incorporated into the Project Review and Categorisation (EP1), while a key element of EP IV (under EP2 for Environmental and Social Assessment) is that an assessment of climate change risks is expected in an ESIA.

For projects that have Scope 1 & 2 GHG emissions of over 100,000 tonnes of CO2 equivalent per annum, there are also other requirements linked to alternative analysis and client annual reporting on GHG emissions.

13.3 Potential Project Impacts upon Climate Change

13.3.1 Construction

Note: The expected quantity of fuel to be consumed during construction is not known and will depend on the number of mobile equipment & diesel generators brought to the site (as below), as well as hours of operations and other factors such as efficiency. Therefore, the expected GHGs have not been calculated for the construction phase.

STATIONARY SOURCE FUEL COMBUSTION

The stationary combustion sources used during the construction phase of the Project will primarily relate to temporary Diesel Generators, which will be located around the site in EPC and sub-contractor administration & office areas.

MOBILE SOURCE FUEL COMBUSTION

The construction phase of the Project will necessitate an amount of mobile equipment/plant and vehicles to facilitate works. Such equipment (such as excavators, rollers, cranes, pneumatic compressors, and other vehicles will be ample on the site, and are expected to be used in most construction processes. Such equipment will be fuelled by either diesel or unleaded petrol.

Loss of Carbon Sinks

The Project is located in a desert area of Dubai that in the vast majority is void of significant vegetative ground cover and lacks voluminous biomass that would present stores of carbon.

Stores of carbon on-site relate to Ghaf trees and an amount of very low lying and sporadic grasses and limited shrubs (ref. terrestrial ecology section of this ESIA). These stores are very limited, and although the construction phase will result in the removal of ground cover vegetation, it is noted that as a protected species the Ghaf trees are required to be translocated. As such, this is not expected to result in significant loses of carbon storage, besides that linked to the limited ground cover (where it does not re-establish) and any loses linked to the survivability of translocated Ghaf trees.

13.3.2 Operations

PRIMARY OPERATIONS

As a renewable energy project, there is essentially a neutral operational impact on GHGs, as the Project will not combust fossil fuels, or otherwise reduce (or otherwise affect) existing carbon sinks. A key benefit of the Project is the resulting lowering of the carbon intensity of the grid produced electricity in Dubai.

As the Project forms part of the longer-term and wider Dubai Integrated Energy Strategy, it is not possible to determine specific savings of GHGs for the Phase V project against reductions in power output elsewhere (which may occur in part from a variety of other projects, or at other times). However, it is possible to make a comparison of GHGs mitigated against a grid factor for GHG emissions if conventional fossil fuel-based technology had been developed to cater for this energy capacity.

The GHG emissions avoided over the operational phase have been calculated below using 2019 UAE grid GHG emissions factor data. The table below shows estimated $CO_{2\text{-eq}}$ that will be avoided per year rounded to nearest 1000 tonnes, compared with typical grid generation emissions.

Table 13-1 Estimated CO2 Emissions mitigated in Tonnes per year

YEAR	RELATIVE (NET) EMISSIONS (tCO_2EQ/YEAR)
1	1,134,000
2	1,130,000
3	1,126,000
4	1,122,000
5	1,118,000
6	1,114,000
7	1,110,000
8	1,106,000
9	1,102,000
10	1,098,000
11	1,094,000
12	1,090,000
13	1,086,000
14	1,083,000
15	1,079,000
16	1,075,000
17	1,071,000
18	1,067,000

Year	Relative (Net) Emissions (tCO_2eq/year)
19	1,063,000
20	1,059,000
21	1,055,000
22	1,051,000
23	1,047,000
24	1,043,000
25	1,039,000

Note: The calculation methodology has not been disclosed. Also, rounding has been used to prevent disclosure of expected generation data.

Emergency Fuel Combustion

Emergency Diesel Generator

The Project has an emergency diesel generator that will be located on-site. This generator is not expected to be used unless in the circumstance of grid blackout conditions, where the generator would provide an amount of power load to enable the safe operation of the plant in such circumstances. Such situations of use are considered highly unlikely and as such, its use is unexpected.

Fire-Fighting Pumps

The Project will include diesel operated firefighting pumps for certain fire systems at the site. As the use of these pumps is also reserved for emergency operations only, the emissions from such usage have not been considered.

Mobile Source Fuel Combustion

Mobile source GHG emissions during operations will only relate to the few vehicles being use on-site for O&M purposes and for the commuting of the small number of staff that will be required to operate the Project. The Project does not require key supply chains (i.e. regular deliveries or removals) and is not expected to require significant maintenance. Therefore, emissions from associated vehicular movements or other transportation are expected to be minimal.

USE OF OZONE DEPLETING SUBSTANCES (ODS)

SF6

It is expected that sulphur hexafluoride (SF6) is to be used in high voltage electrical equipment as the insulating gas, as part of the Gas Insulated Switchgear (GIS), and associated facility of the main PV project. There may be some leakage from the GIS, or where mishandled.

Refrigerants

Trace amounts of refrigerants will be used in chiller packages were needed on-site for air conditioning, refrigerators etc.

Where applicable, the EPC contractor and O&M Company will take into consideration the requirements of the Montreal Protocol concerning applicable ODS.

13.4 The Vulnerability of the Project to Climate Change

13.4.1 Climate Physical Risks

According to the 'National Climate Change Plan of the United Arab Emirates' covering the period 2017 – 2050, 'the most vulnerable areas to climate change in the UAE are water, coastal, marine and dryland ecosystems; buildings and infrastructures; agriculture and food security; and public health. Based on the analysis of past and present anthropogenic drivers, future projections using climate models suggest an increase in the UAE's annual average temperature of around 1°C by 2020 and 1.5-2°C by 2040.[4] The effects of climate change are likely to be felt most severely in coastal zones, where marine habitats will suffer from rising water temperatures and salinity, whereas infrastructure will be tested by storm surges and sea-level rise. Other risks include weakened food security and health damages from extreme weather events.'

The Project will require little staff to work outdoors during long-term operations. Primary project staff will be security, control room operators, administration teams and some maintenance engineers, most of which will be based indoors, although sufficient air conditioning capacity will be required. The number of these staff working outdoors will be limited and as such impacts to the workforce from possible rising temperatures due to climate change are expected to be limited.

The Project is located inland in an area of the country that experiences relatively stable weather patterns, with limited rainfall. Due to the geography, the Project will be protected from the potential impact of seas level rise, however, it may result in increased rainfall during

4 Abu Dhabi Global Environmental Data Initiative (AGEDI), 2015 Regional Atmospheric Modeling for the Arabian Gulf Region – Future Scenarios and Capacity Building. Final Report for AGEDI's Local, National, and Regional Climate Change Programme.

certain seasons (i.e. winter); based on increased evaporation and rainfall rates due to future higher temperatures.

There are no specific watercourses (permanent or wadis) on, or through the site. In the event of warmer temperatures and any dry periods (i.e. during the summer), there may be a resulting increase in the severity or frequency of dusty days and dust storms.

Based on the high-level assessment of risk factors above, the potential for climate-based risks affecting the project is considered to be minimal.

13.4.2 Climate Transition Risks

Given the Project as a solar PV plant, there are not expected to be specific risks related to future low carbon economies (policy, regulations etc.) or future public perceptions of the Project that are considered to be risks at this stage.

14 COMMUNITY HEALTH, SAFETY & SECURITY

This chapter assesses the impacts relating to the health, safety and security of the local community who live and work in the surrounding area and may be subject to project-related impacts.

The majority of secondary impacts relating to the local community in terms of air quality, noise, wastewater, waste etc., have been addressed in specific chapters elsewhere in this ESIA. This chapter, therefore, concentrates more specifically on the potential emergency impacts that could relate to the project and the security of the project to avoid instances of trespass, malicious intrusions and other misdemeanours.

The primary purpose of this chapter is, therefore, to identify specific management measures regarding the community, health, safety and security.

14.1 Standards and Regulations

Local Order No. 11 of 2003 concerning Public Health and Community Safety in the Emirate of Dubai (and Local Order No. 2 of 2004 amending Local Order No. 11 of 2003) provides regulatory requirements for preventing public health hazards, ensuring public safety and controlling infectious diseases and/or pests.

International financial institutions will require adherence to IFC Performance Standard 4 on Community Health, Safety and Security. This standard establishes requirements for the safeguard of the local community from potential risks associated with the project including impacts associated with the introduction of communicable disease, loss of ecosystem function, site access and operation, material use etc. It requires the Client (and Project) 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.

14.2 Observations and Baseline Conditions

There are few communities or other residential receptors in the proximity of the Project, which are not considered to be in the direct Project area of influence. Given the nature of the Project, associated construction and operation activities and distance from the Project site, these receptors will not be directly affected by the Project and therefore are not considered 'Affected Communities'. Impacts relating to the local community in terms of air quality, noise, wastewater, waste etc., have been addressed in specific chapters elsewhere in this ESIA. Project-related activities might increase the risks associated with those who may visit publicly accessible areas close to the site, as well as road users that coincide with roads used for Project access.

14.3 Potential Impacts

14.3.1 Construction Phase

COMMUNITY HEALTH – COVID-19 AND OTHER INFECTIOUS DISEASES

Although there are no specific communities affected by the Project or in proximity (as receptors), the location of worker accommodation may have a possible impact on community health, where integration occurs.

The peak construction phase of the Project will require approximately 1,000 workers as well as suitable accommodation areas for these workers, located off-site. It is expected that the majority of site staff will be sub-contractor workers who will be based across different areas of Dubai Emirate, depending on the specific location of contractor compounds.

It is noted that Dubai has fairly well-segregated areas for worker accommodation. These are typically permanently rented accommodation blocks in certain areas of the Emirate. These areas are typically not linked to areas in which the wider public and local population would frequent, however, they are often in high-density areas of other worker accommodation, with local services linked to these workers and accommodation needs. As such, it is likely that workers from the project will often be in contact with other workers and occasionally (but to a far lesser extent) with the wider non-labourer populations in Dubai.

Hence, there is some potential for the spread of diseases within the local community, particularly those areas close to the accommodation

COMMUNITY SAFETY

All construction projects have potential risks relating to public safety that could arise, particularly regarding the use of high-powered equipment, heavy construction equipment, excavations, transportation amongst others, including fire and pollution releases.

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; however, this rarely occurs. Unlike the operational phase, there is less opportunity of widespread risks that could potentially affect the public and environment as a single event (e.g. large-scale pollution incidents, dust dispersion, explosions etc.). Due to the isolation of the project site, such instances are unlikely to affect a large number of the public, with any risks being more likely at the other nearby solar park facilities.

Risks to public safety will be appropriately addressed and prepared in the construction phase 'Emergency Preparedness and Response Plan' and training regarding this plan. Construction personnel should be trained in emergency procedures and the potentially affected receptors should be notified of procedures to follow by means via relevant communication channels.

SECURITY

The construction phase of the Project will require site-based security at the gates and on patrol around the site to prevent non-authorised parties (including the public) from accessing the construction site. This is to minimise the potential for construction site incidents to occur.

All security provisions will need to be guided by a security plan prepared based on a security risk assessment. Given the precedent of other projects in the solar park, armed security is not anticipated.

TRANSPORTATION

During the construction phase there will be multiple vehicles driving to and from the site on a daily basis. These vehicles include, busses for site personel, personal vehicles from site personel, vehicles from site visitors, trucks from material suppliers and service vehicles.

Traffic flow on the Majlis road is not anticipated to noticbly increase during construction. As stated in section 2.8.2, the expected daily averages for vehicles during the peak construction phase are not expected to be more than 60 vehicles per day. Given the limited number of addtional vehicles, the increase of risks to instances such as road traffic accidents will also be limited.

Table 14-1 Community Health, Safety and Security Mitigation & Management Measures -Construction

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Potential for community exposure to diseases near to worker accommodation areas	• The Health and Safety Teams on site will provide advice during training/inductions on exposure to diseases, including federal, Dubai and project requirements for COVID-19 (or any other infectious disease that may be present). • 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. • Any reportable disease shall be diagnosed by the authorized occupation health centre doctor. Diagnosis includes identifying any new symptoms or any significant worsening of existing symptoms. • Any external and internal spreading diseases shall be diagnosed and take 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 of project activities will be avoided or minimised.
Emergency Situations with regard to the use of high-powered equipment, heavy construction equipment	• 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. • All high-risk areas including fuel storage areas will be secured with internal fencing and will be patrolled by security throughout the day. • Appropriate mechanisms for emergency control (e.g. firefighting equipment) will be placed at suitable positions around the site.
Security	• The project will employ its 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 the enabling work's stage. • All vehicles entering the site will require pre-approved clearance and will need to be registered. • Gate intercom system to be installed for visitor access. • Project security will record all instances of incoming vehicles. • CCTV will be installed at key locations around the site and 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.
Increase in traffic	• Access roads and entrances to be signed. • Minimise the number of road movements as much as practicable. 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.

14.3.2 Operational Phase

COMMUNITY SAFETY

Although expected to be minimal for a Solar PV project, the Project will carry certain risks that could result in impacts to public/external party safety where such impacts are transferred or received outside of the Project boundaries. Such impacts are unlikely to occur but may relate to fire, VOC fumes, explosions, spills of back-up generator fuels and un-warranted/accidental releases of wastewater.

The extent of such impacts may range outside of the boundaries of the project and require the involvement of outside agencies to help manage and abate such impacts (e.g. Civil Defence, Police and Army).

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

SECURITY

Gates shall be installed in the boundary fence at all entry/exit points. The security fence will include anti-climb guard, barbed wire on top, CCTV system to monitor the perimeter and provide operational overviews and details of the site. The project will also include site-based security at the Project entrance who will patrol the site to prevent the public from trespassing to the site and any malicious intrusion during operation of the Plants.

Security arrangements will be in line with the UAE National Standards. In addition to this, security personnel will receive internal training regarding grievances, reporting such grievances and dialogue with any members of the local community.

TRANSPORTATION

Transportation impacts during operations are not expected to result in any changes, as the operation of the solar plants may not require continuous delivery of materials or other equipment to operate. There will be occasional deliveries and waste removals from the site, which is not expected to result in an increase in the amount of traffic on the site access road (Majlis road). Daily staff movements may also contribute to minimal additional vehicle flows on access roads.

Table 14-2 Community Health, Safety and Security Mitigation & Management Measures - Operation

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Emergencies with regards to fire, VOC fumes, explosions etc.	• 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. • All high-risk areas including fuel storage areas will be secured with internal fencing and will be patrolled by security throughout the day. • Appropriate mechanisms for emergency control (e.g. firefighting equipment) will be placed at suitable positions around the site.
Security	• The project will employ its 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 the enabling work's 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 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. • Security arrangements will be in line with the UAE National Standards. In addition to this, security personnel will receive internal training aligned to the UN requirements on the control of force by law enforcement officials. Additional training will be provided to access gate staff regarding grievances, reporting such grievances and dialogue with any members of the local community.
Increase in traffic	• Access roads and entrances to be signed. • Minimise the number of road movements as much as practicable. 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.

14.4 Monitoring

Monitoring of Community Health, Safety & Security will be undertaken as is 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.

15 WORKER CONDITIONS AND OCCUPATIONAL HEALTH & SAFETY

15.1 Standards and Regulations

15.1.1 National Regulations

Federal Law Federal Law No. 8 of 1980 concerning Regulation of Working Relations, the 'Labour Law', is a comprehensive law that regulates all aspects of labour relations in UAE between employers and employees from employee entitlements to industrial safety, preventive measures, health and social care for workers and its Ministerial Orders or Decrees (see Section 3).

15.1.2 Lender Requirements

In line with EP requirements, the IFC Performance Standards apply to the Project. IFC PS 2 on 'Labour and Working Conditions' recognises that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. This includes rights for direct, contracted and supply chain workers (as applicable for key primary supply chains).

PS 2 is in part guided by several International Labour Organisation (ILO) conventions, as follows:

- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
- ILO Convention 98 on the Right to Organize and Collective Bargaining;
- 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; and
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.

In addition to this, PS 2 outlines certain requirements for projects linked to HR policies, management, working conditions and terms of employment (other elements not linked to the ILO conventions above, as well as key processes for occupational health & safety management and grievance redress.

15.2 Potential Impacts

15.2.1 Construction Phase

WORKER / WORKFORCE EXPLOITATION

The Project will have several parties contributing as part of the construction phase, of which there will likely be varying internal processes and protocols for each concerning HR, labour/workforce employment and other related elements. The Project parties employing staff (as a collective of the workforce) are expected to include:

- Project Company;
  - Relatively few staff during construction, but potentially with external Project advisors.
- EPC Contractor;
  - Comparably a large number of staff (To be confirmed, but likely the most out of any individual party).
- Sub-Contractors.
  - Expected to make up the majority of workers on-site, but from various companies

Certain parties may also engage contract staff (e.g. from agencies), where additional manpower is required. There will also be suppliers/service providers (e.g. for deliveries, waste management) who will have access to the site and will be exposed to certain risks.

At this stage, the EPC Contractor has estimated that the peak workforce (total for the Project as a whole) will likely be 1,000 personnel, although this may vary and is largely dependent on the numbers of workers engaged by sub-contractors (agreements with whom are to be arranged).

Examples from other projects within the region have shown that there can be instances of forced labour (including bonded labour), labour with poor contracting conditions, or lacking processes in place to manage such elements. Therefore, potential risks exist regarding the above and are expected to be more prevalent at lower ends of the project hierarchy, particularly for sub-contractors and agency/contract manpower that may need to be engaged

OCCUPATIONAL HEALTH AND SAFETY

Common activities were undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals works undertaken at height, in confined space, with electrical hazards etc. can all introduce risk to the health and safety for the workforce. In particular, risks are more likely to be apparent for those who are not familiar, applicably qualified or otherwise well trained 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 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. This must include applicable training, management systems and availability of equipment where necessary for safety.

COVID-19 and other Infectious Disease

Regarding the on-going COVID-19 pandemic and/or other infectious diseases or illnesses that may arise in the future, there is a particular risk associated with the spread of such disease within workforces. This is prominent in construction working environments that require close contact and the sharing of equipment between workers.

Risks of infectious disease spread are real and can be problematic to entire workforces, also affecting project schedules and completion of works.

WORKING CONDITIONS, WELFARE & ACCOMMODATION

Labour exploitation on construction sites, unfortunately, has become a reality in some parts of the world. Inequality in income, education and opportunities has led to opportunistic immoral practices with labourers and site staff suffering as a consequence.

This can include a lack of welfare provisions on-site such as clean drinking water, hygienic and ample toilet facilities, hand basins (with soaps/hand wash), temperate rest areas, food and other amenities necessary to the works and the environment.

Although worker accommodation in Dubai has been regulated more strictly in recent years, there is still a risk that companies providing accommodation can significantly impact the lives of Project workers, not only in the choice of accommodation but the decisions on living areas, the number of workers per room, facilities and amenities available to workers, maintenance accommodation areas and provisions of associated services (e.g. catering, waste management etc.).

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

Table 15-1 Workers Condition & Occupational Health & Safety Mitigation & Management Measures – Construction

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Workers Conditions-Terms of Employment, Non-discrimination and equal opportunities, Working Relationships	• Key Project parties will establish HR Policies and processes consistent with the requirements of National Labour Law, IFC PS 2 and associated ILO conventions. • Key Project parties 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. • Project employment relationships shall be on the principle of equal opportunity and fair treatment, and will not discriminate concerning 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. • Project parties will not make employment decisions based on personal characteristics, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. • Project parties 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). 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 per national law, will not be deemed discrimination.
Workers Conditions-Forced Labour	• Project parties 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. • Such requirements are also applicable in the hiring of agency/other contracted manpower, for which processes should be in place by the Project party to undertake due diligence on the agency providing the manpower. Where potential risks of forced labour are identified other suppliers with reputable processes and controls should be sought.
Workers Conditions-Child Labour	• Project parties will comply with all relevant national laws provisions related to the employment of minors. • In any event, project parties 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 shall be subject to an appropriate risk assessment • Such requirements are also applicable in the hiring of agency/other contracted manpower, for which processes should be in place by the Project party to undertake due

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	diligence on the agency providing the manpower. Where potential risks of child labour are identified other suppliers with reputable processes and controls should be sought.
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 Project parties anticipate collective dismissals associated with the proposed project, the parties shall 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 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	• A grievance mechanism for workers will be provided to raise reasonable workplace concerns. Workers will be informed of the grievance mechanism at the time of hiring, and make it easily accessible to them. The mechanism will 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 will not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or a substitute for grievance mechanisms provided through collective agreements.
Workers Conditions-Supply Chain	• Project parties shall devise and implement applicable controls to ensure the measures herein are implemented by any sub-contractors and are internally checked/audited. • Project parties will take reasonable steps to inquire about the use of child labour and forced labour in their supply chains and try to exert influence where possible or identify other suppliers.
Occupational Health and Safety	• The EPC Contractor will provide all workers with a safe and healthy work environment, considering inherent risks and specific classes of hazards associated with the project. • The EPC Contractor shall implement and maintain an OHS management system considering specific risks associated with the project, legal requirements and duty of care. • The EPC Contractor shall be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system shall be in-line with recognised international best practice and as a minimum, this plan shall 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.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	- Training of workers, and the 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
Worker Welfare (site)	• Project parties will ensure that welfare provisions are available on-site, including but not limited to: - Hygienic and regularly cleaned toilets (commensurate to applicable requirements or good practices for the quantity required on-site, or in areas of the site), - Basins and running clean water, with hand, wash for hand cleaning, - Rest areas (with air conditioning, chairs and tables), - Clean drinking water available in working areas (at a suitable temperature) - If applicable suitable and hygienic areas for eating and storing food (including refrigerators, heating devices [ovens/microwaves] etc)
Worker Accommodation	• An accommodation that complies with the IFC & EBRD Workers Accommodation: Processes and Standards (2009)

15.2.2 Operational Phase

The operational phase of the Project is expected to have a vastly reduced workforce compared with the construction phase. Furthermore, only staff from the Project Company and O&M Company are expected on-site. However, there may be a certain number of sub-contracted staff providing security and other services

WORKER / WORKFORCE EXPLOITATION

As the vast majority of staff will be direct employees of the Project Company or O&M Company the potential risks associate with worker exploitation are expected to be limited due to consistent processes in place as part of the respective HR management systems, assuming they are appropriately designed and resources.

However, where there is an agency/contract staff the risks of exploitation (particularly forced and child labour) may be more prevalent.

OCCUPATIONAL HEALTH AND SAFETY

The risks associated with the operational phase of the project are anticipated to be less than during the construction phase due to reduced site activity and requirements for heavy plant and machinery.

However, there will remain occupational health and safety risks attributable to the operational phase associated with maintenance and inspection requirements and with particular emphasis on electrical hazards (given the nature of the Project). Maintenance and inspection

will also still require the use of site vehicles and activities that pose risks to human health and safety.

Also, shading provided by the PV modules could provide refuge for dangerous/poisonous fauna such as scorpions and reptiles.

The severity and likelihood of risks during the operational phase will also 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

Operational activities will need to plan for and enforce the just and fair treatment of operation and maintenance staff (including any engaged sub-contractors). An allowance will need to be made for site staff welfare facilities, as applicable.

No accommodation requirements planned for the Project

Table 15-2 Workers Condition & Occupational Health & Safety Mitigation & Management Measures - Operation

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Workers Conditions- Terms of Employment, Non-discrimination and equal opportunities, Working Relationships	• Project parties will establish HR Policies and processes consistent with the requirements of National Labour Law, IFC PS 2 and associated ILO conventions. • Project parties 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. • Project employment relationships shall be on the principle of equal opportunity and fair treatment, and will not discriminate concerning 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. • Project parties will not make employment decisions based on personal characteristics, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. • Project parties 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). 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 following national law, will not be deemed discrimination.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Workers Conditions-Forced Labour	• Project parties 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 and IFC PS 2. • Such requirements are also applicable in the hiring of agency/other contracted manpower, for which processes should be in place by the Project party to undertake due diligence on the agency providing the manpower. Where potential risks of forced labour are identified other suppliers with reputable processes and controls should be sought.
Workers Conditions-Child Labour	• Project parties will comply with all relevant national laws provisions related to the employment of minors. • In any event, project parties 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 shall be subject to an appropriate risk assessment • Such requirements are also applicable in the hiring of agency/other contracted manpower, for which processes should be in place by the Project party to undertake due diligence on the agency providing the manpower. Where potential risks of child labour are identified other suppliers with reputable processes and controls should be sought.
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 Project parties anticipate collective dismissals associated with the proposed project, the parties shall 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 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	• A grievance mechanism for workers will be provided to raise reasonable workplace concerns. Workers will be informed of the grievance mechanism at the time of hiring, and make it easily accessible to them. The mechanism will involve an appropriate level of management and address concerns promptly, using an understandable and transparent process

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	that provides feedback to those concerned, without any retribution. The mechanism will not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or a substitute for grievance mechanisms provided through collective agreements.
Workers Conditions-Supply Chain	• Project parties shall devise and implement applicable controls to ensure the measures herein are implemented by any sub-contractors and are internally checked/audited. • Project parties will take reasonable steps to inquire about the use of child labour and forced labour in their supply chains and try to exert influence where possible or identify other suppliers.
Occupational Health and Safety	• The O&M Company will provide the workers with a safe and healthy work environment, considering inherent risks and specific classes of hazards associated with the project. • The O&M Company shall implement and maintain an OHS management system considering specific risks associated with the project, legal requirements and duty of care. • The O&M Company shall be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system shall be in-line with recognised international best practice and as a minimum, this plan shall 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 the 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
Worker Welfare (site)	• Project parties will ensure that welfare provisions are available on-site, including but not limited to: - Hygienic and regularly cleaned toilets (commensurate to applicable requirements or good practices for the quantity required on-site, or in areas of the site), - Basins and running clean water, with hand, wash for hand cleaning, - Rest areas (with air conditioning, chairs and tables), - Clean drinking water available in working areas (at a suitable temperature) - If applicable suitable and hygienic areas for eating and storing food (including refrigerators, heating devices [ovens/microwaves] etc)

15.3 Monitoring

Monitoring of labour and working conditions will be necessary through the applicable HR management systems established as part of the project. It is expected that the EPC Contractor (for construction) and the O&M Company (for operations) will be the primary parties for ensuring that measures are internally audited and processes are in place for sub-contractors or other suppliers.

16 HUMAN RIGHTS IMPACT ASSESSMENT

16.1 Overview

With new requirements under EP IV and increased attention being given to the accountability of businesses for their impact on human rights, a Human Rights Impact Assessment has been conducted to assess and evaluate the impacts of the Project's activities on the human rights of workers and people in surrounding communities.

Please note that several of the items outlined below are already covered in the preceding chapters related to Labour and Communities respectively, but have been set out here as a consolidated high-level assessment section of the ESIA. Given that the potential human rights risks related to workers and the communities, mitigation measures from these chapters are not repeated here.

16.2 Standards and Regulations

16.2.1 National Context and Regulations

The United Arab Emirates (UAE) is committed to the promotion and protection of human rights at home and around the world. The foreign policy of the UAE is based on the principles of justice, equality, and human rights. The UAE is determined to make a positive difference at the global level by working constructively to support the implementation of the principles of the Universal Declaration of Human Rights.

Since its founding in 1971, the UAE has placed a high priority on respect for human rights following international human rights standards and is committed to the continual improvement of its laws and practices, based upon the country's cultural heritage and religious values, which enshrine justice, equality and tolerance.

The UAE is part of the following international human rights treaties:

- International Convention on the Elimination of all Forms of Racial Discrimination (CERD) (1974)
- Convention on the Rights of the Child (CRC) (1997)
- Convention on the Rights of Persons with Disabilities (CRPD) (2010)
- Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (CAT) (2012)

The UAE is also a party to:

- The Convention on the Prevention and Punishment of the Crime of Genocide
- The Four Geneva Conventions of 1949 and their Two Additional Protocols of 1977

- Nine ILO Conventions, including on the subjects of working hours, forced labour, labour inspections, night work for women, equal pay, the minimum age for employment and the worst forms of child labour
- The Convention against Transnational Organized Crime and its Protocol to Prevent Suppress and Punish Trafficking in Persons, Especially Women and Children (The Palermo Protocol)
- The Arab Charter of Human Rights

The continual improvement of the protection of the rights of workers is a national priority. The UAE's status as an attractive place of work for people from around the world has made it a major recipient of foreign labour, which is of benefit to the workers, the sending countries, and the UAE.

16.2.2 Lender Requirements

In line with EP IV requirements, the United Nations Human Rights Guiding Principles apply to the Project. HRGP II on "The corporate responsibility to respect human rights" recognises that it is the responsibility of businesses and corporations to respect human rights. It is a global standard of expected conduct for all business enterprises wherever they operate. It exists independently of a States' ability and/or willingness to fulfil their human rights obligations and does not diminish those obligations. The Foundational principles to take into consideration are:

- Principle 11: Business enterprises should avoid infringing on the human rights of others and should address adverse human rights impacts with which they are involved.
- Principle 12: The responsibility of business enterprises to respect human rights refers to internationally recognized human rights – understood, at a minimum, as those expressed in the International Bill of Human Rights and the principles concerning fundamental rights set out in the International Labour Organization's Declaration on Fundamental Principles and Rights at Work
- Principle-13: The responsibility to respect human rights requires that business enterprises avoid causing or contributing to adverse human rights impacts through their activities, and address such impacts when they occur;
- Principle-14: The responsibility of business enterprises to respect human rights applies to all enterprises regardless of their size, sector, operational context, ownership and structure. Nevertheless, the scale and complexity of the means through which enterprises meet that responsibility may vary according to these factors and with the severity of the enterprise's adverse human rights impacts
- Principle-15: Business enterprises should have policies and processes appropriate to their size and circumstances in place, including:

The following Operational principles should also be taken into consideration.

- Principle-16: Policy commitment
- Principle-17 to 21: Human rights due diligence
- Principle 22: Remediation

16.3 Potential Impacts upon Human Rights

16.3.1 Construction

Note: Several of the potential impacts on Human Rights, in particular, those affecting workers have already been assessed with mitigation included in section 15 "Workers Conditions and Occupational Health and Safety".

INDIGENOUS PEOPLES

Under the UN Guiding principles, the rights of indigenous people should be protected. This includes ensuring prior, free informed consent is provided before any project development is allowed to take place on their land.

This Project is located within the Al Marmoom Conservations Reserve, an isolated desert area with little residential or agricultural settlements. The Solar Park is owned by DEWA and forms an integral part of the conservation area itself. As part of the surveys and background research, no indigenous people have been identified in or nearby the Project location. Therefore no further assessment has been undertaken in regards to indigenous people.

LOCAL COMMUNITIES

The Project location is an isolated area of Dubai away from population clusters and communities. Based on the Project's area of influence (as per potential impacts upon different environmental and social parameters), there are not expected to be specific Project impacts to communities, besides a temporary increase of construction traffic on local roads.

It is noted that a Grievance Mechanism has been established within the standalone Stakeholder Engagement Plan (SEP) for the Project, which will allow any third-parties to raise grievances against the Project without cost, retribution or fear of negative consequences.

PROJECT WORKERS

As is outlined in the preceding chapter, the Project will have several parties contributing as part of the construction phase, there will likely be various internal processes and protocols related to HR and worker management for each party. Certain parties will also engage contract staff (e.g. from agencies), where additional manpower is required. There will also be suppliers/service providers (e.g. for deliveries, waste management) who will have access to the site and will be exposed to certain risks of exploitation.

Examples from other projects within the region have shown that there can be instances of forced labour (including bonded labour), labour with poor contracting conditions, or lacking processes in place to manage such elements. As previously assessed, this is a potential impact for the Project, especially for contract staff, or those of sub-contractors. Such risks will need to be carefully safeguarded through policy and internal processes (including monitoring and audit).

16.3.2 Operations

As a PV project, the site would be static with little impact outside the site boundary. Furthermore, a vastly reduced workforce compared with the construction phase is expected. As a result, the only potential impact on human rights that could potentially be expected is the exploitation of workers.

PROJECT WORKERS

As previously discussed in Section 15.2.2, the vast majority of staff will be direct employees of the Project Company or O&M Company and as such the potential risks associated with the exploitation of workers are expected to be limited, however, the aforementioned mitigation will need to be implemented to ensure risks are minimised.

16.4 Monitoring

The protection of human rights is an ongoing process and this should be reflected in the Projects internal management policies. As discussed in Section 15, monitoring of labour and working conditions will be necessary through the applicable HR management systems established as part of the project.

It will be expected from the EPC Contractor (for construction) and the O&M Company (for operations) to be the primary parties for ensuring that measures are internally audited and processes are in place to protect subcontractors, labourers or other suppliers.

17 CUMULATIVE IMPACT ASSESSMENT

The following section presents the Cumulative Impact Assessment (CIA) that has been conducted for the Project as part of the ESIA process and in line with the IFC requirements and the IFC Good Practice Handbook on 'Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets' (2013).

17.1 Scope and Objectives of the Cumulative Impact Assessment

Cumulative impacts are 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'. 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 greatest 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 human activities as well as natural stressors such as droughts or extreme climatic events.

The objectives and expected outcomes of the CIA process are as follows:

- Identification of VECs 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 comparable benchmarks;
- Avoidance and minimization of cumulative impacts of the Project on the VECs, under the mitigation hierarchy; and
- Monitoring and management measures to ensure the VEC viability over the life span of the development or its impacts.

For this ESIA and in light of plans to extend the capacity of the Mohammed bin Rashid Al Maktoum Solar Park up to 5,013MW, the CIA has been undertaken to establish whether there are barriers to future development within the projects area of influence, such as:

- Is there sufficient environmental carrying capacity available for future development?
- Are there any factors that may restrict future development?
- Are there any key factors of concern that may relate to the development/operation of other projects in tandem with the proposed Phase V 900MW PV Project?

17.2 Scoping Phase I – Identification of Other Activities and Environmental Drivers

Typically, the assessment of cumulative impacts would be based upon solid documented development plans/strategies and announced projects. In the case of this cumulative impacts assessment, there is two technology and capacity option being considered regarding future development plans for the MBR Solar Park. The underway, planned and potential future projects in the local area of Project influence are listed below.

Table 17-1 Known and Documented On-going, Planned and Future Projects in the Project's Area of Influence

Project Name	Description	Distance to Project	Start-Up Date
Phase I 13MW Solar Plant	The Phase I 13MW Solar Plant consists of the pilot solar plant of the Mohammed bin Rashid Al Maktoum Solar Park. Consideration will be given to the VECs which may be incrementally impacted by the operation of this development.	Approximately 5km to the northwest of the Project	Began operations in October 2013
Phase II 200MW Solar Plant	The Phase II 200MW Solar Plant consists of a 450ha solar plant which became operational in April 2017. Consideration will, therefore, be given to the VECs which may be incrementally impacted by the operation of this development.	Approximately 3.6km to the northwest of the Project	Began operations in April 2017
Field A of Phase III 800MW Solar Plant	Field A of the Phase III 800MW PV project has recently been commissioned in April 2018 and is currently operational. Consideration will, therefore, be given to the VECs which may be incrementally impacted by the operation of this development	Approximately 2.2km northwest of the project	Began Operations in 2018

Project Name	Description	Distance to Project	Start-Up Date
Field B of the Phase III 800MW Solar Plant	Field B of the Phase III 800MW PV are yet to undergo construction and are scheduled to be completed in phases in 2019 and 2020	Approximately 2.3km to the north end of the Project boundary	Began Operations in 2019
Field C of the Phase III 800MW Solar Plant	Field C of the Phase III 800MW PV are yet to undergo construction and are scheduled to be completed in phases in 2019 and 2020	Directly adjacent to the north end of the Project boundary	Began Operations in 2020
Phase IV 700MW CSP Technology	To be completed in Phases between 2021 and 2022	Directly adjacent to the northeastern end of the project boundary.	Between 2021 and 2022
Phase V 900MW PV	The Project	The Project	Between 2021 and 2023
Future Solar Plant Phases– Up to 5,000MW	Combination of PV and Concentrated Solar Power (CSP) technologies	Unknown at this stage	By 2030 - Phases of implementation currently not defined

Future phases of the solar plant are not confirmed and prone to changes based on DEWA's requirements. There is no firm expectation on the development of Phase VI (or others) at this stage, although they can be expected at some point given the strategic plans in place for the MBR Solar Park. Since all the identified projects (and possible future projects) are solar plants (PV and CSP), the identification of cumulative will be simplified since potential environmental impacts from other developments will be similar to those identified for the Project.

17.3 Scoping Phase II – Identification of VECs, Spatial and Temporal Boundaries

17.3.1 Valued Environmental and Social Components

The following table presents the environmental and social components that have been considered in this ESIA, as well as the justification to either, include or exclude them from this Cumulative Impact Assessment. Only those environmental and social parameters envisaged having potentially significant cumulative impacts in addition to the proposed Project have been included in the Cumulative Impact Assessment.

Table 17-2 Valued Environmental & Social Components (VEC's)

Environmental and Social Components	Considered VEC to be included in the CIA?	Justification for Inclusion or Exclusion
Air Quality	Yes	According to the Project timeline provided, the Phase V Project is scheduled for 2021 and during this time, construction works at Phase IV project would still be in progress. However, as has been assessed the distance separation of the two phases is to the extent that there are not expected to be cumulative dust or other air quality impacts. It is possible however that an adjacent future phase (although not confirmed) if undertaken in combination with Phase V construction could have potential cumulative air quality impacts.
Noise and Vibration	Yes	Even though construction of the Phase V project is envisaged to commence during the period Phase IV is also undergoing construction, construction of the Phase V Project is not anticipated to result in cumulative noise and vibration impacts that would be above the WHO ambient noise limit for industrial area. It is possible however that an adjacent future phase (although not confirmed) if undertaken in combination with Phase V construction could have potential cumulative noise impacts.
Terrestrial Ecology	Yes	Project-related impacts with regards to terrestrial ecology would be those associated with the land clearance and loss of typical dune desert habitat, which is a key habitat for ecologically significant fauna and flora within the Al Marmoom Conservation Reserve. Any future phases of development (i.e. up to 5,013MW) will also require land clearance of gravel and dune habitats of the Solar Park. This could be considered as a significant cumulative impact on terrestrial ecology.
Geology, Soil and Groundwater	No	Project-related impacts on soil and groundwater quality would be those related to the potential contamination of soil and groundwater resources during construction as well as during operation. However, the effect of these impacts will be localized and limited within the Project boundaries, with very limited potential for cumulative effects. Furthermore, no extraction of local groundwater resources is envisaged during the construction and operation of the Project.
Waste and Wastewater Management	No	Project-related impacts concerning waste and wastewater management would mainly be those related to the potential deterioration and/or contamination of soil and groundwater resources during construction and operation due to improper or uncontrolled handling, storage, transport and disposal of waste. However, given that each Project will manage its waste with licensed waste handlers and facilities off-site

Environmental and Social Components	Considered VEC to be included in the CIA?	Justification for Inclusion or Exclusion
		(outside of the MBR Solar Park) such impacts are not expected to result in significant cumulative effects.
Archaeology and Cultural Heritage	No	Project-related impacts concerning archaeology and cultural heritage would mainly be those related to the excavation, earthworks and clearance of the Project site and the potential for encountering unknown buried archaeological remains. The risk is considered low and therefore it is not envisaged that significant cumulative impacts will take place.
Landscape and Visual	Yes	Project-related impacts concerning landscape would mainly be those related to the clearance of the Project site, loss of typical desert landscape and impact on receptor visual envelope. Any future phases of development at the Solar Park will also require land clearance of gravel & dune habitat and change in landscape character. This could be considered a significant cumulative impact on the landscape.
Socio-economics	No	Project-related impacts concerning socio-economics would be mainly those related to the creation of employment (beneficial impact) and dissemination of skills both during the construction and operational phases. Given the scale of the Project, significant beneficial cumulative impacts are anticipated (mainly for construction). Note: not included in CIA as it is a positive impact.
Community Health, Safety and Security	No	Project-related impacts with regards to community health, safety and security would mainly be those associated with construction: an influx of workers, public trespassing, as well as incidents (accidents) from the presence of vehicles, heavy plant and machinery. Furthermore, the identified receptors are limited to users of the Majlis road, Falcon Majlis and the small settlement with a mosque. Hence, significant cumulative impacts on other projects are not envisaged.
Worker Conditions & Occupational Health and Safety	No	Project-related impacts with regards to working conditions and occupational health and safety would mainly be those associated with construction and will depend on conditions within the Project site as well as depending on Project-specific construction activities. Significant cumulative impacts with other ongoing projects are therefore not envisaged.
Climate Impacts	No	The cumulative assessment of the Project in combination with other on-going and future MBR Solar Park phases will result in a major positive benefit for climate, in the development of a key renewable energy resource for power generation. This will be a key contributor to the UAE's obligations to the Paris Agreement. Note: not included in CIA as it is a positive impact.
Human Rights	-	Note: Human rights impacts are covered by the Worker and Community sections above.

17.3.2 Geographic Scope

The geographical scope of the CIA covers the footprint of the Project and the MBR Solar Park area which is the designated area for any future development.

17.4 Baseline Conditions of VECs

The environmental baseline conditions with regards to air quality, noise and vibration, terrestrial ecology, landscape and community health, safety and security within the Project site have been established in the respective sections of the ESIA. The environmental baseline conditions with regards to air quality, noise and vibration, terrestrial ecology and landscape in the surroundings of the Project site are expected to be (without full surveys undertaken) relatively similar to those of the Project site.

17.5 Assessment of Cumulative Impacts on VECs

17.5.1 Air Quality Impacts

The local ambient air quality will be potentially affected by increased dust during site clearance, levelling of dunes areas and earthworks as well as by gaseous emissions of nitrogen oxides, sulphur dioxides, carbon monoxide, carbon dioxide from the exhaust of construction vehicles, equipment and temporary power generators.

The construction activities of on-going projects such as the nearby Phase IV 950MW CSP & PV project will give rise to dust-generating activities and the emission of pollutants into the air thereby leading to changes in ambient air quality locally, although this is not expected to result in cumulative impacts with Phase V construction due to distance separation. However, if a future solar park phase is constructed on adjacent land to the Phase V project there may be cumulative impacts (if construction coincides), which has the possibility of resulting in exceedances of the Federal and Local Air Quality Standards. Although impacts would not be expected at human receptors.

17.5.2 Noise and Vibration Impacts

As with air quality if a future solar park phase is constructed on adjacent land to the Phase V project there may be cumulative impacts for noise (if construction coincides), however, the lack of receptors means that impacts will be minimal and largely only related to noise at existing solar park phases and the wider ecological environment.

17.5.3 Terrestrial Ecology Impacts

The site clearance and earthworks of the Project footprint will cause a direct loss of ecologically significant terrestrial habitat of dunes and vegetation, in particular of Ghaf trees

and shrubs that provide food and shelter for small mammals, reptiles and birds, as well as the destruction of any existing burrows for mammals.

The construction activities for future planned projects will also cause a direct loss of ecologically significant terrestrial habitat of dunes, native vegetation and shelter for existing mammals within the affected area and will cause further displacement of Arabian Oryx and Gazelles which are of significant conservation value.

17.5.4 Landscape Impacts

The site clearance and earthworks of the Project footprint (10.2km^2) and the installation of the PV panels will result in changes to the landscape character of the Project area, characterised by open sand and gravel plains and dune habitats.

The construction and operation activities for future planned projects will also cause changes to the landscape character of the Project area, ultimately causing the loss of the open sand and gravel plains and dune habitats.

17.6 Management of Cumulative Impacts

The EIA for the entire Mohammed Bin Rashid Al Maktoum Solar Park takes into consideration the current and future planned phases of the Solar Park and as noted earlier has been prepared on behalf of DEWA and approved by DM-EPSS. This ESIA implicitly covers the assessment of cumulative impacts for all solar projects and considers mitigation and management measures to address potential cumulative effects.

The mitigation measures identified within this ESIA will be applied to this specific Project and will contribute to the minimisation of cumulative impacts.

Of particular significance is the fact that future cumulative impacts due to future expansion plans of the Solar Park will further reduce the size of the natural habitat. As such and for the additional phases of the Solar Park (outside this Project's scope), DEWA should ensure that the potential cumulative impacts with regards to habitat fragmentation are appropriately managed through the implementation of compensation strategies such as the establishment and maintenance of feeding stations along the Solar Park boundaries/fence.

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