



Preliminary Studies for WPP in Starah Governorate

ESIA REPORT NCEC ENGLISH

16/03/2022



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MINISTRY OF ENERGY

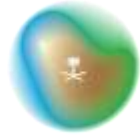


Quality control sheet

Document	ESIA REPORT NCEC ENGLISH
Project	Preliminary Studies for WPP in Starah Governorate
Code	WP7777-TY-WG3-GEN-0002-SR-ESIA NCEC ENG-D01
Authors:	Signed: AH ENVIROMENTAL
	Date: 8/03/2022
Verified	Signed: JVM/RMP
	Date: 16/03/2022
Recipient	Ministry of Energy KSA
Notes	



وزارة الطاقة
MINISTRY OF ENERGY



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR “STARAH WIND POWER PLANT”



ENGINEERING SERVICES TO COMPLETE THE PRELIMINARY STUDIES FOR WIND POWER PROJECTS IN STARAH GOVERNORATE

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July 22

Revision Status

S. No.	Revision No	Description	Prepared By	Checked By	Approved By	Date
1	00	ESIA FOR “STARAH WIND POWER PLANT”	Abderrazzak ZEMZEMI	Elyes OTHMEN	Ennacer BESSGHAIR	24/05/2022
2	01	ESIA FOR “STARAH WIND POWER PLANT”	Abderrazzak ZEMZEMI	Elyes OTHMEN	Ennacer BESSGHAIR	27/07/2022

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ABBREVIATIONS AND ACRONYMS

Acronym	Description
AC	Alternating Current
AH	Anno Hegirae
AHEC	Ali Harbi Environmental Consulting Office
AIS	Air Insulated Switchgear
AoI	Area of Influence
AQMS	Air Quality Monitoring Station
CCTV	Closed-circuit Television
dB	decibel
DC	Direct Current
DG	Diesel Generator
ECRA	Water & Electricity Regulatory Authority
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EMMP	Environmental Management & Monitoring Plan
EP	Equator Principle
EPFI	Equator Principles Financial Institution
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental & Social Management Plan
ESMS	Environmental and Social Management Plan
GAMEP	General Authority for Meteorology and Environment Protection
GBIF	Global Biodiversity Information Facility
GERRI	General Environmental Regulations and their Rules for Implementation
GHG	Greenhouse Gases
GIS	Gas Insulated Substation
HCIS	High Commission for Industrial Security
HV	High Voltage
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
kV	kilo-Volt
kVA	kilo Volt-Ampere
LC	Least Concern
MEWA	Ministry of Environment, Water and Agriculture
MoE	Ministry of Energy
MoU	Memorandum of Understanding
MV	Medium Voltage
MW	Mega-Watt
MWp	Megawatt peak
NAAQ	National Ambient Air Quality Standards
NCEC	National Center for Environmental Compliance
NFPA	National Fire Protection Authority
NREP	National Renewable Energy Program,
O&M	Operation and Maintenance
PMS	Project Management Specialist

PPE	Personnel Protection Equipment
WTGs	Wind Turbine Generators
RCC	Reinforced Cement Concrete
SCADA	Supervisory Control and Data Acquisition
SEC	Saudi Electricity Company
SEP	Stakeholder Engagement Plan
UNESCO	United Nations Educational, Scientific and Cultural Organization
WWTP	Wastewater Treatment Plant
WTGs	Wind Turbine Generators

0. EXECUTIVE SUMMARY

0.1 Introduction

The Kingdom of Saudi Arabia set out the national Vision 2030 that aims to accelerate efforts toward attaining sustainable development goals. In the framework of this Vision, the “National Renewable Energy Program (NREP)” has been launched. This ambitious program aims to ensure renewable energy growth in the Kingdom and offer sustainable alternatives to liquid fossil energy.

In this context, the Ministry of Energy (MoE) proposes to develop a Wind Power plant in Starah, Governate of Al Aflaj, Riyadh Region. The Proposed Development will have a generation capacity of 2000 MW.

The Project will take approximately 24 months to construct, and the operation and maintenance will last 25 years. the power from the Project will be injected into the Saudi Electric Company via substation constructed into the Plant site.

This is the Environmental and Social Impact Assessment (ESIA) report for the construction and operation for the 2000-megawatt (MW) Alternating current wind Power plant.

0.2 The ESIA Process

The key process elements of an ESIA generally consist of (i) initial screening of the project and scoping of the assessment process; (ii) examination of alternatives; (iii) stakeholder identification (focusing on those directly affected) and gathering of environmental and social baseline data; (iv) impact identification, prediction, and analysis; (v) generation of mitigation or management measures and actions; (vi) significance of impacts and evaluation of residual impacts; and (vii) documentation of the assessment process.

The ESIA has been developed in line with the International Finance Corporation (IFC) Performance Standards (PS) as well as the NCEC regulations.

0.3 Project Justification

The Wind Power plant will provide new alternatives for energy and reduce the Kingdom's dependence on traditional energy source represented by petroleum. The project achieves several of strategic goals emanating from the Kingdom of Saudi Arabia’s 2030 vision and the global will, including, but not limited to:

- Reducing carbon emissions resulting from the consumption of fossil fuels.
- Preserving the national natural resources.
- Relying on an inexhaustible source of energy, which is the wind.
- Reducing the cost of producing electricity.
- Supporting global efforts to reduce emissions that cause climate change and global warming.

- Diversifying the sources of Saudi national income by relying on new and clean energy sources.

0.4 The Project description

The Project comprises of a 2000 MW wind power plant on a 60 km² ha in the governorate of Al-Aflaj. It is located 60 km north-west of the city of Layla.

The Wind Power plant will connect to the grid of Saudi Electricity Company via the constructed substations in the site.

The wind turbines for power generation chosen for the project have the following characteristics:

DATA	Details
General Data	
No. of WTGs	324
WTG Rated Power	6.6 MW
Wind Class	IIIA
Cut-in Speed	3 m/s
Cut-out Speed	25 m/s
Rotor	
Diameter	170 m
Swept Area	22,697 m ²
Power Density	290.78 W/m ²
Control	pitch and variable speed
Blades	
Length	83.5 m
Tower	
Height	100, 115, 135, 145, 155, 165 m and site-specific
Technology	
Type	Geared

The project will consist also of

- Transformers: The transformer steps up the AC power to match the grid voltage (expected to be 132 kV).
- Stores, offices and control building.
- Access trucks and fencing.

0.5 Project Phases

The Project will be completed in three phases:

- Construction.
- Operational.
- decommissioning.

Site preparation and construction will involve the clearance of topsoil, installation of fencing and levelling of the site and preliminary earthworks. The site will be marked out, safety and security fencing installed, an access road will be constructed, and internal site access trucks will be constructed. It is anticipated that there will be approximately 1500 workers on the Project site across the 24 months construction phase.

The wind power plant will be operated on a 24 hour, 7 days a week basis with 150 on site workers. Key operational activities will include:

- cleaning of the turbines and all accessories
- management and irrigation on green spaces planted inside the plant
- maintenance of all Project Components
- site security monitoring.

The proposed Project is expected to operate for at least 25 years.

0.6 Project Baseline

The Project Site is located on a flat sandy plain partially covered in gravel. The landscape is natural and does not feature any prominent human interventions. At the same time, high levels of grazing were observed across the Project Site.

Vegetation cover is limited to groups of perennial shrubs/trees. Some parts of the Project Site are completely devoid of any vegetation cover while in others, sparse vegetation was observed. There is no part of the Project Site that has what can be considered as dense vegetation cover. Rodent burrows were only observed at the central part of the Project Site.

Based on the above, below are some considerations to be taken during the different phases of the development of the project:

- Construction at the areas of the highest vegetation cover should be avoided as much as possible. Removal of trees and any perennial shrubs should also be avoided.
- Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances

0.7 Stakeholder Engagement

Extensive stakeholder engagement has been undertaken as part of the ESIA. Through this action all relevant stakeholders have been engaged and their feedback gathered. Chapter 6 describes the stakeholder engagement undertaken to date.

0.8 Impact Assessment

The ESIA identified both potential positive and adverse impacts, as illustrated in the table below. The table summarizes the potential impacts of the Project phases (construction operation and decommissioning) before and after mitigation measures. Mitigation measures that are included

in this Report become set project commitments, which will be implemented by EPC Contractor as part of the Environmental and Social Management Plan (ESMP).

Table 1 : Summary of Impact Assessment Findings

Potential Impact	Significance	Residual significance
	(Pre-mitigation)	(Post-Mitigation)
Construction Phase		
Impact on Land Use	Minor	Negligible
Impact on topography and drainage	Minor	Negligible
Impact on soil contamination		
· Soil contamination due to waste generation	Minor	Negligible
· Soil contamination due to leaks /spills	Minor	Negligible
Impact on soil erosion and compaction	Minor	Negligible
Impact on surface water availability	Moderate	minor
Impact on ground water availability	Negligible	negligible
Impact on surface water quality		
· Contamination by wastewater	Minor	Negligible
· Contamination by spills /leaks	minor	Negligible
· Contamination by loads sediments	minor	Negligible
Impact on groundwater quality	Minor	Negligible
Impact on air quality		
Dust from construction	Moderate	Minor
Exhaust/fugitive emission	Minor	Negligeable
Odors	Minor	Negligible
Impact on ambient noise	minor	Negligible
Impact on traffic and transport	Moderate	minor
Impacts on ecology and biodiversity	minor	Negligible
Impact on occupational health and safety	Moderate	Minor
Socio-economic impacts		
Impact on community health and safety	Minor	Negligible
Impact on employment	Positive	Positive
Impacts from migrants workers (social impacts, spreading of infectious disease...)	Minor	Negligible
Archeology and cultural heritage	No Impact	No impact
Operation and Maintenance Phase		
Impact on Land and Soil Environment		
Soil contamination due to accidental spills leaks	Moderate	Minor
Waste generation	Moderate	minor
Impacts on water quality and quantity		
Water availability	moderate	Minor
Water quality	minor	negligeable
Air quality	minor	Negligible
Impact on Ambient Noise Levels	minor	negligible

Potential Impact	Significance	Residual significance
	(Pre-mitigation)	(Post-Mitigation)
Impact on Ecology and biodiversity	minor	Negligible
Landscape and Visual Impact	minor	Negligible
Occupational Health and Safety	Moderate	Minor
Traffic and transport	Negligible	Negligible
Impact on climate change	Positive	Positive
Impact on employment	positive	Positive
Decommissioning phase		
Impact on soil environment	minor	minor
Impact on Water Environment	minor	negligible
Impact on air quality	Negligible	Negligible
Impact on ambient noise	minor	negligible
Impact on employment and community	Minor	negligible
Impact on occupational health and safety	Moderate	Minor

0.9 Positive Impacts

Positive impacts are associated with economy and livelihoods, through the creation of approximately 200 jobs during construction and 140 during operation. There will be on the job training and capacity development opportunities.

0.10 Development and Implementation of ESMP

An ESMP has been developed to specify the standards and controls required to manage and monitor the environmental and social impacts. To achieve this, the ESMP Framework identifies potential adverse impacts from the planned activities and outlines mitigation measures required to reduce the likely negative impacts on the biophysical and social environment. The ESMP actions, contained in this report are legally binding on authorization of the ESIA and ESMP by the NCEC.

In summary, the proposed Project will benefit the local economy through job creation and upskilling of the local workforce as well as generation of additional electricity for the country which will contribute to implement the NREP program. Whilst adverse impacts have been identified, there are no potential impacts, which cannot be managed and outweigh the positive impacts of the Project and the objective of the Project in developing renewable energy sources in the Kingdom of Saudi Arabia. Finally, those adverse impacts that have been identified in the ESIA have been minimized through the implementation of the ESMP, which is based on the approach of continual improvement following international best practice.

Positive impacts will be enhanced and maximized through the ESMP by the EPC Contractor commitment to ongoing engagement with the community and key stakeholders and an open and

transparent dialogue and hiring process throughout the life cycle of the Project. On the basis of this ESIA Report it is recommended that the Project continue as planned.

1. INTRODUCTION

1.1 General background

The Kingdom of Saudi Arabia set out the national Vision 2030 that aims to accelerate efforts toward attaining sustainable development goals. In the framework of this Vision, the “National Renewable Energy Program (NREP)” has been launched. This ambitious program aims to ensure renewable energy growth in the Kingdom and offer sustainable alternatives to liquid fossil energy.

It is the responsibility of the Ministry of Energy (MoE) to oversee the implementation of the (NREP) through the development and implementation of renewable energy initiatives and projects, to develop renewable energy policies and strategies for the Kingdom in cooperation and integration with the energy ecosystem, and work on business development and market studies to ensure optimal use of this kind of energy and maximize its economic and social returns.

In this context, the Ministry of Energy (MoE) proposes to develop a wind power plant project in Al-Aflaj Governate in Riyadh region. The Proposed Development will have a generation capacity more than 2000 MW.

Through these investment programs, the Ministry of Energy is working to diversify the national energy mix used in electricity production, increasing the share of natural gas and renewable energy sources to approximately 50% by 2030 while reducing the use of liquid fuel.

1.2 Study objective

The Ministry of Energy (MoE) has assigned **TYPESA** to provide technical assistance to complete the preliminary studies of a wind power plant project as a part of the National Renewable Energy Program (NREP) in in Al-Aflaj Governate in Riyadh region, Kingdom of Saudi Arabia.

TYPESA has commissioned **AH Environmental Consulting Office** as a sub-contractor to carry out the ESIA study on the Proposed Development. ESIA Study will be prepared by AH Environmental Consulting Office in accordance with the relevant national and international environmental laws and regulations.

The ESIA study describes the main features of the proposed development, discusses the environmental and social baseline within which it is commissioned, identifies its potential adverse and beneficial impacts, together with appropriate management, mitigation and monitoring measures and recommend an Environmental and Social Management Plan (ESMP).

This study has been produced in accordance with the international standards required by international finance Corporation (IFC) as the project may require financing from such international bank. In addition, in line with the IFC requirements, the ESIA study also addresses

Saudi legislative requirements relating to environmental impacts assessment and environmental protection which have been presented in the applicable reference framework below.

1.3 Study scope

1.3.1 The scope of the study

1.3.1.1 Define the spatial area of the study

The study area covered by the ESIA generally represents the area that is exposed to potential impact of the project. This area may experience significant impacts due to the project itself or in combination with other impacts resulting from other projects.

The study area covered by the project ESIA generally includes the area of disruption that the project may cause. This includes impact assessment on several environmental and social parameters (such as infrastructure, socio-economic parameters, health and safety and community security, etc.). each parameter is treated separately.

1.3.1.2 Assessment time range

The project will be developed in three successive phases as mentioned below:

- Design phase
- Construction phase
- Operation phase

It is important to note that the ESIA study does not cover facilities in connection with the project, or the works being undertaken to construct or operate such facilities. The facilities concerned by the ESIA include only the Wind Power plant.

1.3.1.2.1 Design phase

This stage of the project includes proper engineering planning and design and adherence to best building practices so that negative project impacts can be dealt with at an early stage.

1.3.1.2.2 Construction phase

This phase includes construction works on the site, which will be undertaken by a contractor. It includes transporting the project components to the site as well as preparing the site for installation of WTGs, foundations, internal roads, buildings, etc.

1.3.1.2.3 operation stage

This phase includes works to be performed by the contractor and project operator which is expected to include the normal day-to-day operations of the Wind Power plant operation and routine maintenance.

1.3.1.2.4 Study aspects evaluation

The following Table 2: Scope of study presents the fixed aspects that will be treated in the ESIA study.

Table 2: Scope of study

Items	Importance	The treatment suggested in the study
Executive Summary	Important as a layout summary	Brief summary of ESIA
Introduction	Important to provide project background	Presentation and methodology description of evaluation
Legal and Administrative Framework	Important to explain the study requirements	Describe the basic and regulatory requirements to comply with environmental rules
Project description	Important to understand the overall scope of the project	A detailed description of the activities and facilities in the construction and operation phase
Air quality and meteorology	Important	The sources of air pollutants will be assessed Ambient air quality measurements will be taken for sulfur, nitrogen and carbon monoxide oxides, in addition to dust, in the locations surrounding the project area for a period of 24 hour. The nature of the weather and climate in the project area will be described.
terrestrial environment	Important	Conduct a site tour to determine the baseline Soil samples will be taken in the project area The nature of the terrestrial environment in the project area will be described.
Bird study	Very Important	Since October, work has started on a basic survey on the current status of birds at the project site. Work is ongoing, targeting the autumn season. The objective was to monitor and record the number and behavior of migratory and resident soaring birds passing through the project site. The results of the study on the current status of birds will be presented at the project site

Items	Importance	The treatment suggested in the study
		and the main impact of the project on birds will be assessed.
biological resources	Important	Biological resources in the project area will be comprehensively described based on field visits and previous studies of the whole area
Biodiversity	Very important	Biodiversity survey at the project site
Noise	Important	Conducting a basic survey Noise measurements will be taken for a period of 24 hours in different locations in the project site
Waste management	Important	Study the expected waste generation during the construction and operation phase and determine the appropriate disposal options
economic and social aspects	Important	An evaluation will be done in the study
Traffic and Transport Infrastructure	Not important	It will be studied comprehensively
Basic environment for facilities and uses	Important	Determining the demand for water supply, electricity, sewage treatment and waste disposal, and assessing exploitation and impacts
Antiquities and Cultural Heritage	important	It will be ensured that the site is far from any archaeological and historical places
Health and safety aspects	important	Develop a plan for potential accidents and appropriate mitigation during construction and operation
Environmental Monitoring and Management Plan	important	Recommend an environmental and management plan and its content to be implemented by the company

1.3.2 Environmental Measurements

Environmental measurements will be made according to the requirements of the National Center for Environmental Compliance Control and will include the following points:

- Noise measurements for 24 hours and results evaluation (4 points).
- Ambient air quality measurements for sulfur and nitrogen oxides and carbon monoxide in addition to dust in the locations surrounding the project area for a period of 24 hours and results evaluation (5 points).
- soil samples (35 points).

1.3.3 ESIA Methodology

The study methodology was designed in order to achieve the requirements of the National Center for Environmental Compliance (NCEC) and international requirements in the preparation of environmental impact assessment studies. The study methodology included doing the following works:

- Office work: It includes a study of similar projects, and some geographical, demographic and historical characteristics of the site.
- Site visits and conducting of a comprehensive survey, including topography of the site, roads and transportation infrastructures, population and socio-economic life.
- A study of the current state of the environment, including air quality monitoring, dust, and noise levels, and taking samples of soil and water.
- Studying the project components and the project phases that will be followed.
- Studying the project technical characteristics.
- Assessment of the project environmental impacts (positive and negative) on the environment, social and economic life and biodiversity.
- Several alternatives, recommendations, and procedures have been prepared that will reduce the impact of the project to an acceptable extent, during the phases of operation, maintenance, and project decommissioning
- Preparation of an environmental management plan in order to ensure compliance with the environmental standards required for the construction and operation phase, and the implementation of recommendations prepared for this purpose.

1.3.4 Structure of the Environmental Impact Assessment Study

The report of the Environmental Impact Assessment Study will be prepared in accordance with the requirements of the environmental assessment in the Kingdom of Saudi Arabia and the best practices required by the National Center for Environmental Compliance. In order to present the ESIA in a logical format, it has been divided into several sections:

- Section one: presents an executive summary of the ESIA, including the main outcomes and conclusions.
- The second section: consists of the main text of the ESIA, with identification of mitigation, management and control measures and follows the general structure:
 - 1) an introduction
 - 2) Project Description
 - 3) The institutional and organizational framework of the study
 - 4) Impact assessment methodology
 - 5) Description of the surrounding environment
 - 6) Stakeholder engagement plan
 - 7) Impact identification, analysis and evaluation and mitigation measures

- 8) Plans
- 9) Conclusion

The Saudi General Environmental Protection Regulation obliges the project owner/developer to prepare an environmental impact assessment study for the project and take approval for construction and operation. Thus, this study comes in response to the requirements of the Saudi environmental system and the executive regulations. At the international level, the United Nations Agenda 21 states in many of its chapters the importance of studying the impact on the environment to reduce environmental degradation and before that, the Rio de Janeiro Declaration, which states that “Governments must subject any project that is likely to cause damages to the environment to an Environmental Impact Assessment”.

This study aims to achieve the following detailed objectives:

- Assessment of the environmental impacts of the project.
- Improve the social impact of the project.
- Determine the capacity of the project environment to support additional environmental impacts.
- Looking for the procedures that would mitigate the negative environmental impacts of the project.
- Studying the available alternatives that contribute to mitigating of the environmental impacts of the project.
- Determining the degree of compliance with the requirements of the National Center for Environmental Compliance and international standards.
- Preparing recommendations that would reduce the project impacts on the environment during the operation phase.
- Putting the necessary information and studies in the hands of the decision maker in order to build plans and programs.

2. PROJECT DESCRIPTION

2.1 Introduction

This section provides a description of the project in terms of technologies adopted, location, facilities and associated project infrastructure and activities during the project lifecycle and facilitates an identification of the potential impacts on resources and receptors that could result from Project activities during the planning, construction & operation, and decommissioning stages.

2.2 Project overview

The project consists of wind power plant with a production capacity of 2000 megawatts of alternating current (AC) provided by 324 wind turbines erected. The Starah wind park is located about 200 km south of the city of Riyadh and 60 km west from Layla, in Al-Aflaj Governorate. The project extends over an area of 300 square kilometres as shown in the maps below

2.3 Project justification

The wind power plant will provide new alternatives for energy and reduce the Kingdom's dependence on traditional energy source represented by oil. The plant will also contribute to distributing electric power to multiple areas such as residential and commercial projects. The project achieves several of strategic goals emanating from the Kingdom of Saudi Arabia's 2030 vision and the global will, including, but not limited to:

- Reducing carbon emissions resulting from the consumption of fossil fuels.
- Preserving the national natural resources.
- Relying on an inexhaustible source of energy, which is the wind.
- Reducing the cost of producing electricity.
- Supporting global efforts to reduce emissions that cause climate change and global warming.
- Diversifying the sources of Saudi national income by relying on new and clean energy sources.

2.4 Project location

The Starah wind park is located about 200 km south of the city of Riyadh and 60 km west from Layla, in Al Aflaj Governorate. The project area is bordered on the north by the village of Al-Ahmar and bordered on the south by the village of Al-Haddar. The table below shows the coordinates the parcel boundaries. The project extends over an area of 300 square kilometres as shown below.

Table 3: The project boundaries coordinates

POINTS	LONGITUDE	LATITUDE	POINTS	LONGITUDE	LATITUDE
1	46.260246	22.810454	19	46.261681	22.719026
2	46.291676	22.968437	20	46.240736	22.753989
3	46.319039	22.968437	21	46.113645	22.602206
4	46.366921	22.984203	22	46.145640	22.546350
5	46.366854	23.014395	23	46.135860	22.534580
6	46.252435	23.008261	24	46.023986	22.546871
7	46.219356	22.980558	25	46.005469	22.515891
8	46.194683	22.891583	26	46.033040	22.445840
9	46.169370	22.896205	27	45.903140	22.379710
10	46.112148	22.841542	28	45.864419	22.303293
11	46.099066	22.791327	29	45.908690	22.121806
12	46.090872	22.742858	30	46.064693	22.026282
13	46.089990	22.683930	31	46.147565	22.300227
14	46.077729	22.637068	32	46.066562	22.336772
15	46.080418	22.607693	33	46.153164	22.435839
16	46.101903	22.603093	34	46.178932	22.483542
17	46.294191	22.612773	35	46.294886	22.611397
18	46.289710	22.646375			

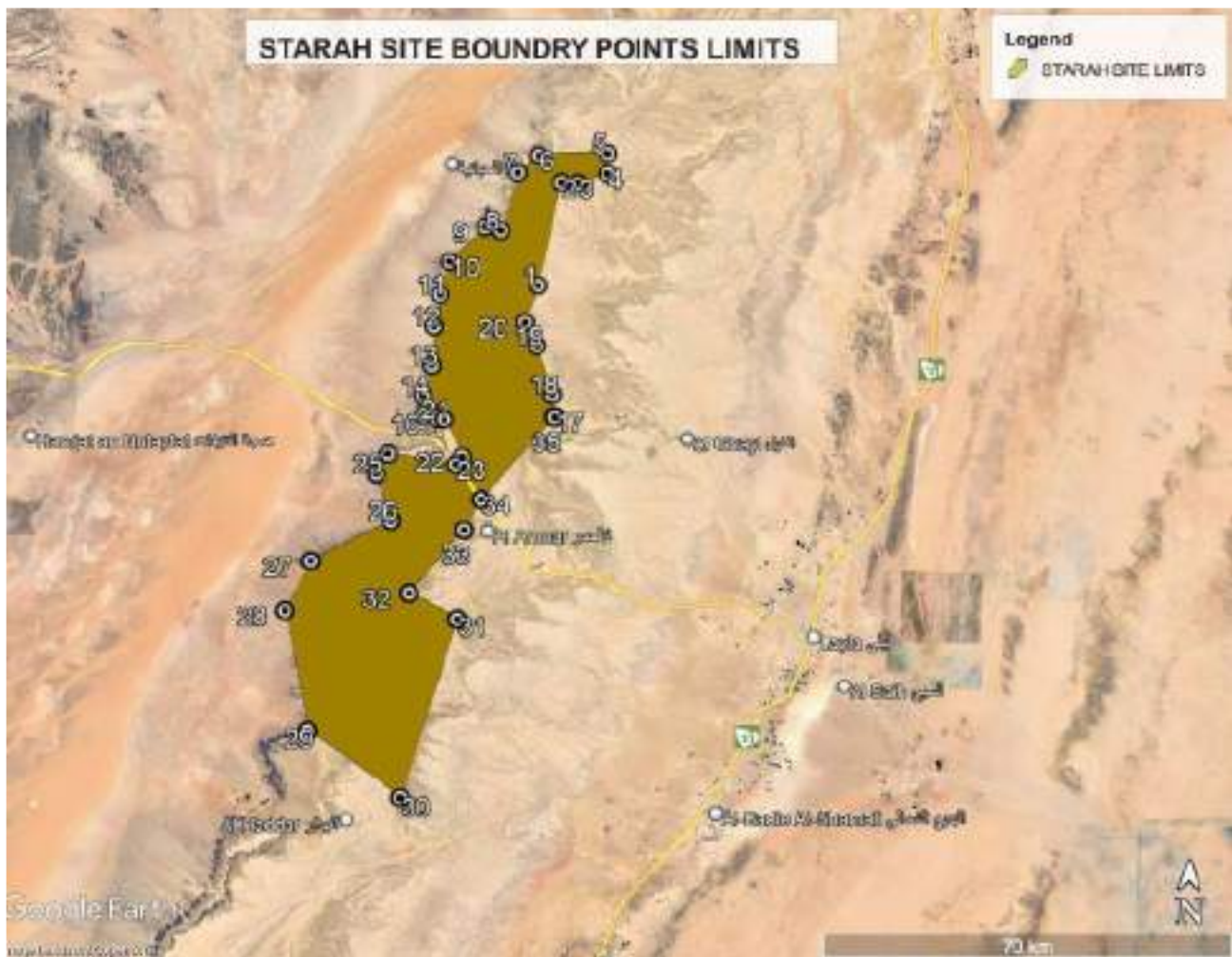


Figure 1: Area for project developing



Figure 2: Photos from the site of the proposed project

2.5 Site Access

The possible accesses to the project area have been analyzed. At this stage, the point of arrival of the wind turbine components is not known with certainty, although for this preliminary analysis it has been considered that they will come from the north-east of the country.

In any case, access is not an important variable in the analysis of this first phase, since there is road access in the northern area of the project, as well as in the central and southern areas. Figure 3 below shows the map of the potential accesses.

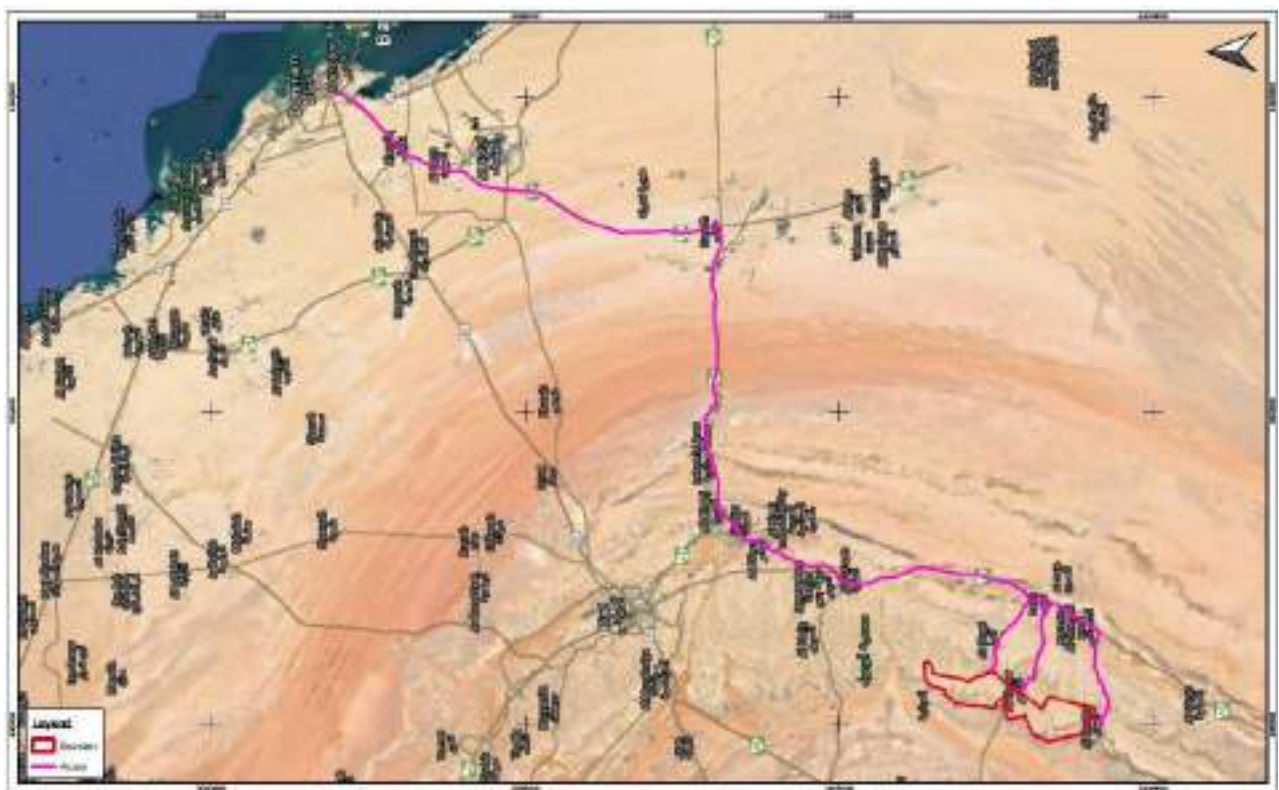


Figure 3: Potential access to the site

2.6 Wind power generation overview

Wind flows from regions of higher pressure to regions of lower pressure. The larger the atmospheric pressure gradient, the higher the wind speed and thus, the greater the wind power that can be captured from the wind by means of wind energy-converting turbine.

Wind power generation means getting the electrical energy by converting wind energy into rotating energy of wind turbine and converting that rotating energy into electrical energy by the generator.

In Fact, wind turbine technology relies on harvesting the kinetic energy in wind (i.e. movement of wind) and turning it into mechanical energy which in turn is used for electricity generation.

To capture wind, turbines consist of rotor blades which are elevated from the ground using towers to take advantage of faster and less turbulent wind. As wind speed increases, the rotor blade begins to rotate which then spins a shaft that is connected to a generator thereby converting wind energy to electricity.

Wind turbines produce Direct Current (DC) electricity from wind, which can be used for grid connected power generation. However, electricity at the grid is usually in a different form (known as Alternating Current (AC)) and thus inverters are used to convert DC current to AC current. In addition, wind turbines produce electricity at a certain voltage which must be matched to the grid it connects to. Therefore, transformers are used to convert the output to a higher voltage that matches the grid.

2.7 Description of Project Facilities, Components and Activities

The following table (Table 4: Summary of Key project components) provides a summary of the key components for the Project, along with a detailed description of each of those components below.

Table 4: Summary of Key project components

Component	Description
Project Generation Capacity (MW)	2000
Technology Type	Wind Power
Number of Wind Turbines	324
Rated Power per Turbine (MW)	6.2
Turbine Rotor Diameter (m)	170
tower Height (m)	100, 115, 135, 145, 155, 165 m, it depends on site specificity
Wind turbine technology	Geared
Project area to be covered	390 km ²
Infrastructure and Utilities	This includes internal road network; underground cables and Overhead Transmission Lines (OHTL), warehouse, offices and control buildings; substations; Electrical Specific facilities and associated facilities.

2.7.1 Wind turbines

The project will comprise in total of 324 wind turbines generators (WTGs) distributed on site as shown in the following figure.

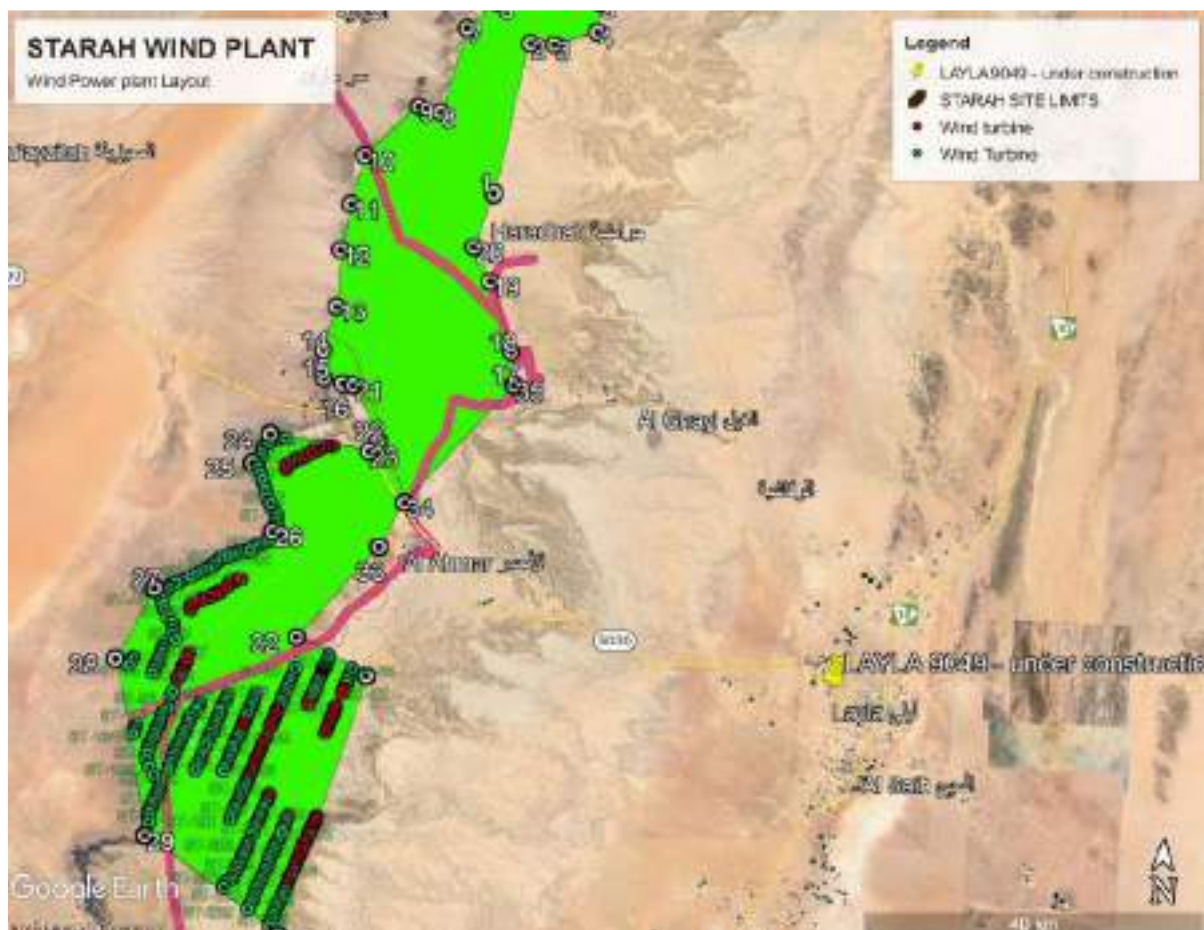


Figure 4 : *Starah Wind Power Plant layout*

2.7.1.1 Wind turbine characteristics

Generally, a wind turbine consists of a foundation, tower, nacelle, rotor blades, a rotor hub, and a transformer. The foundation is used to bolt the tower in place. The tower contains the electrical conduits, supports the nacelle, and provides access to the nacelle for maintenance. Typically, three (3) blades are connected to the hub which then connects with the nacelle; the box-like component that sits atop the tower and which most importantly contains the gearbox (which steps up the revolutions per minute to a speed suitable for the electrical generator) and the generator (which converts the kinetic energy into electricity).

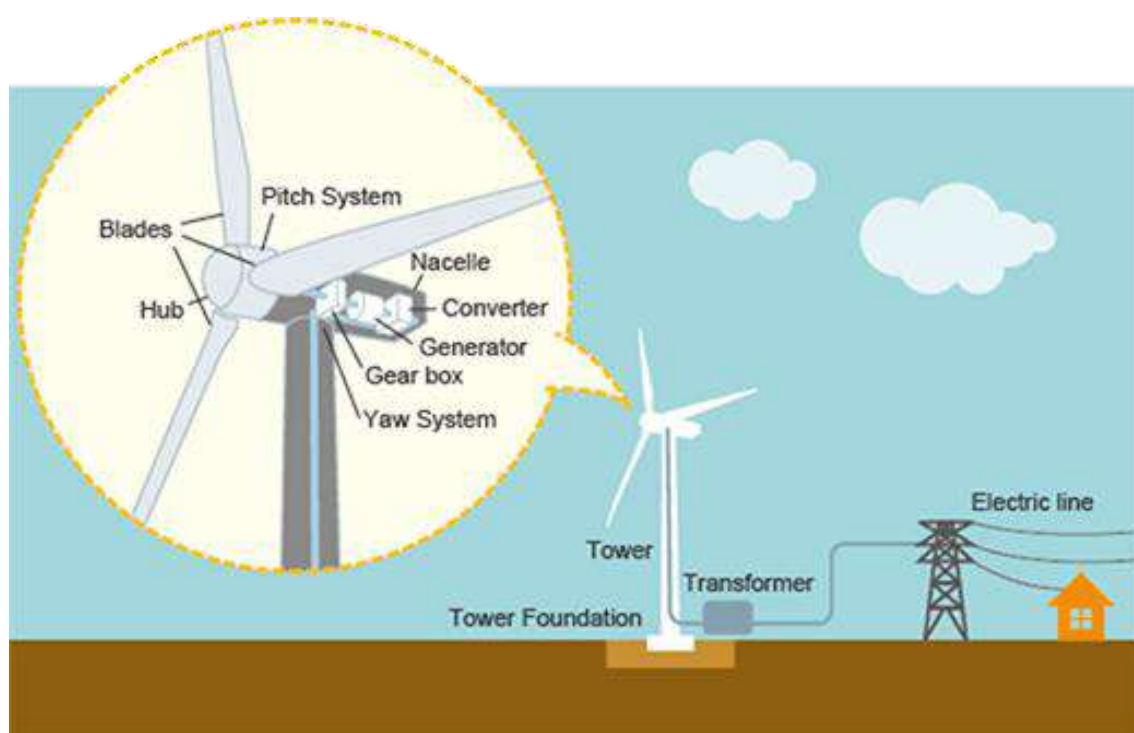


Figure 5: *Main Components of a wind turbine* (source <https://www.global.toshiba/ww/products-solutions/renewable-energy/products-technical-services/wind-power.html>)

The technical specification of the projected turbines is given by the following table.

Table 5: Turbine specifications

DATA	Details
General Data	
No. of WTGs	324
WTG Rated Power	6.6 MW
Wind Class	IIIA
Cut-in Speed	3 m/s
Cut-out Speed	25 m/s
Rotor	
Diameter	170 m
Swept Area	22,697 m ²
Power Density	290.78 W/m ²
Control	pitch and variable speed
Blades	
Length	83.5 m
Tower	
Height	100, 115, 135, 145, 155, 165 m and site-specific
Technology	
Type	Geared

2.7.1.2 Wind turbine parts

As mentioned, the projected wind turbine will have the parts (see Figure 6) detailed as follow.

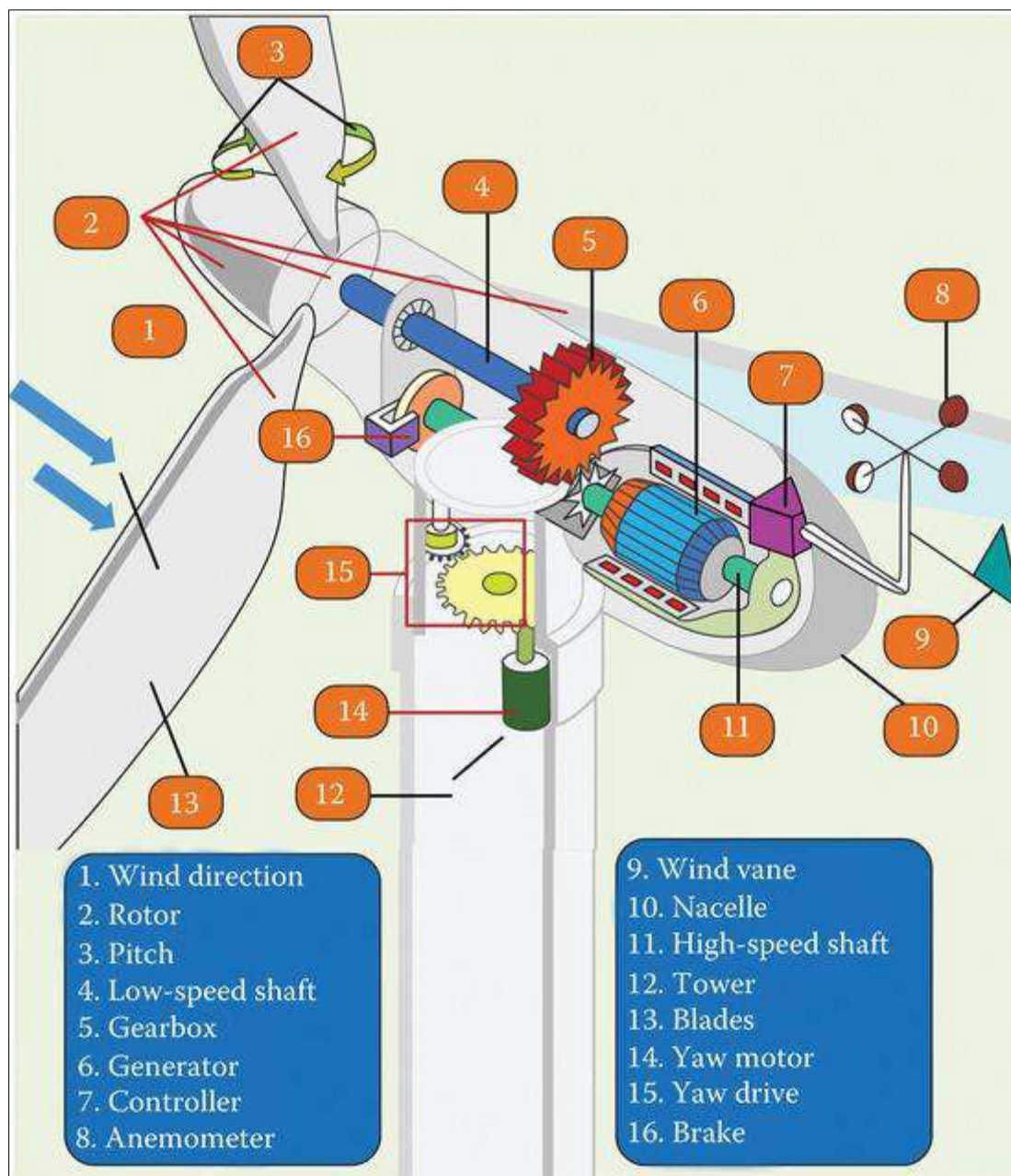


Figure 6: Principal components of a wind turbine: tower, rotor, nacelle, and foundation (underground).

2.7.1.2.1 Foundation

The foundation is under the ground for the onshore turbines; it cannot be seen because it is covered by soil. It is a large and heavy structured block of concrete that must hold the whole turbine and the forces that affect it.



Figure 7: Wind turbine foundation in construction

2.7.1.2.2 Tower

The tower in most modern turbines is round tubular steel of a diameter of 3–4 m (10–13 ft), with a height of 75–110 m (250–370 ft), depending on the size of the turbine and its location. The rule of thumb for a turbine tower is that it has the same height as the diameter of the circle its blades make when rotating. Normally, the taller a turbine is, it is subject to more of the wind with higher speed. This is because the farther we are from the ground, the faster the wind (wind does not have the same speed at various distances from the ground).

2.7.1.2.3 Rotor

The blades and hub together form the turbine's rotor. The rotor is the rotating part of a turbine; it consists of (mostly) three blades and the central part that the blades are attached to, the hub. A turbine does not necessarily have to have three blades; it can have two, four, or another number of blades. But the three-blade rotor has the best efficiency and other advantages.

2.7.1.2.4 Blades

Blades are the spinning parts that extract wind kinetic energy of the wind and then convert it to torque.

When wind flows across the blade, the air pressure on one side of the blade decreases. The difference in air pressure across the two sides of the blade creates both lift and drag. The force of the lift is stronger than the drag and this causes the rotor to spin.

The blades have the form of an airfoil (same as the wings of an airplane) to be aerodynamic. As well, they are not flat and have a twist between their root and their tip. The blades can rotate up to 90° about their axes. This motion is called blade pitch.

There are physical limits to the amount of power that can be extracted realistically from the wind by blades. It can be shown theoretically that any form and orientation of blades it is possible only to extract a maximum of 59.3% of the power from the wind. This is known as the Betz limit.

Blades are not solid; they are hollow and are made of composite material to be light and strong. The trend is to make them larger (for more power extraction), lighter, and stronger.

Most turbines have three blades which are made mostly of fiberglass. Turbine blades vary in size, but a typical modern land-based wind turbine has blades of over 170 feet (52 meters).

2.7.1.2.5 Pitch System

The pitch system adjusts the angle of the wind turbine's blades with respect to the wind, controlling the rotor speed. By adjusting the angle of a turbine's blades, the pitch system controls how much energy the blades can extract. The pitch system can also "feather" the blades, adjusting their angle so they do not produce force that would cause the rotor to spin. Feathering the blades slows the turbine's rotor to prevent damage to the machine when wind speeds are too high for safe operation.

2.7.1.2.6 Hub

The function of the hub is to hold the blades and make it possible for them to rotate with respect to the rest of the turbine body.

2.7.1.2.7 Nacelle

The nacelle is housing on top of the tower that accommodates all the components that need to be on a turbine top. There are quite a number of components for the proper and healthy operation of a complicated electromechanical system that a turbine is. A major turbine part among these components is the generator and the turbine shaft that transfers the harvested power from wind to the generator through a **gearbox**.

2.7.1.2.8 Drivetrain

The drivetrain on a turbine with a gearbox is comprised of the rotor, main bearing, main shaft, gearbox, and generator. The drivetrain converts the low-speed, high-torque rotation of the turbine's rotor (blades and hub assembly) into electrical energy.

2.7.1.2.9 Low-Speed Shaft

Part of the turbine's drivetrain, the low-speed shaft is connected to the rotor and spins between 8–20 rotations per minute.

2.7.1.2.10 Main Shaft Bearing

Part of the turbine's drivetrain, the main bearing supports the rotating low-speed shaft and reduces friction between moving parts so that the forces from the rotor don't damage the shaft.

2.7.1.2.11 Gearbox

The gearbox is a vital component of wind turbines; it resides in the nacelle. A gearbox increases the main shaft speed from around 12–25 rpm* (for most of today's turbines) to a speed suitable for its generator. For this reason, the shaft on the generator side is called "high-speed shaft."

2.7.1.2.12 High-Speed Shaft

Part of the turbine's drivetrain, the high-speed shaft connects to the gearbox and drives the generator.

2.7.1.2.13 Yaw System

Because a turbine must follow the wind and adjust its orientation to the wind direction, its rotor needs to rotate with respect to the tower. This rotation is called yaw motion in which the nacelle and the rotor revolve about the tower axis.

The yaw drive rotates the nacelle on upwind turbines to keep them facing the wind when wind direction changes. The yaw motors power the yaw drive to make this happen.

2.7.1.2.14 Generator

The generator is the component that converts the mechanical energy of the rotor, harnessed from wind to electrical energy. A generator has the same structure as an electric motor.

The generator is driven by the high-speed shaft. Copper windings turn through a magnetic field in the generator to produce electricity. Some generators are driven by gearboxes (shown here) and others are direct-driven where the rotor attaches directly to the generator.

At the commercial production level, all electricity generation is in the three-phase alternative current. In general, the choice of generator, therefore, is synchronous or asynchronous (induction) generator. Nevertheless, the generator associated with wind turbines, thus far, is the induction generator because a synchronous generator must turn at a tightly controlled constant speed (to maintain a constant frequency).

Because a generator must be rotated at a speed corresponding to the frequency of the electric network (50 or 60 Hz in most countries), it must be rotated faster than the turbine rotor. Most generators need to be turned at 1500 rpm (for 50 Hz) and 1800 rpm (for 60 Hz). In no way, it is feasible for a turbine rotor to move that fast. A gearbox, therefore, must increase the turbine rotor (main shaft) rotational speed to a speed that can be used by the generator.

Experience has shown that the gearbox in a turbine is a problematic component. This is due to the fact that the energy in the wind does not remain constant for a relatively acceptable length of time. It continuously fluctuates, because of the nature of wind. This causes the gear teeth to undergo overload and hammering stress that leads to fatigue and failure. In addition, the gearbox is a heavy item in the nacelle on the top of a turbine.

2.7.1.2.15 Control panel

A wind turbine is a complex system to control because the source of power (wind) is not in our control. Wind speed can continuously change, even from one second to the next. The power output from a turbine, therefore, must be adjusted to the variation of wind at all times. Thus, a control panel is installed in the bottom and inside the tower to accommodate power production with the variation of wind conditions.

The way this adjustment of power to wind speed is carried out is that each turbine has a performance curve called power curve. It is used as a power schedule by a computer in the turbine control panel to adjust all components that need to be controlled, based on this curve and according to wind speed. A typical sample of this curve is shown in (to obtain wind speed values in miles per hour multiply the values in m/sec by 2.2).

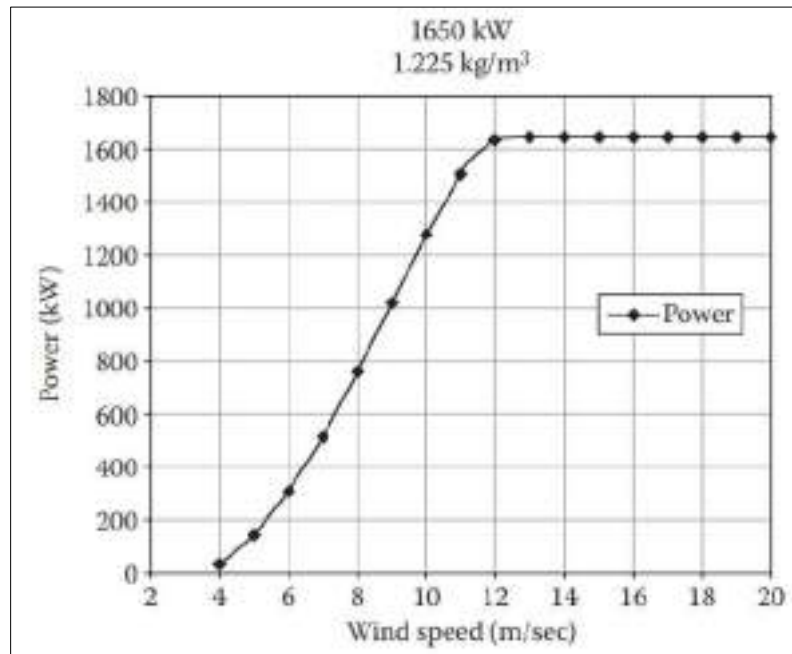


Figure 8: Typical power curve for a wind turbine.

The figure below depicts part of the components inside the control panel in a wind turbine. This control panel is normally at the bottom and inside the tower.



Figure 9: control circuitry for a wind turbine.

2.7.1.2.16 Controller

The controller allows the machine to start at wind speeds of about 7–11 miles per hour (mph) and shuts off the machine when wind speeds exceed 55–65 mph. The controller turns off the turbine at higher wind speeds to avoid damage to different parts of the turbine. Think of the controller as the nervous system of the turbine.

2.7.1.2.17 Brake

Turbine brakes are not like brakes in a car. A turbine brake keeps the rotor from turning after it's been shut down by the pitch system. Once the turbine blades are stopped by the controller, the brake keeps the turbine blades from moving, which is necessary for maintenance.

2.7.1.2.18 Wind Direction

Determines the design of the turbine. Upwind turbines—like the one shown here—face into the wind while downwind turbines face away. Most utility-scale land-based wind turbines are upwind turbines.

2.7.1.2.19 Wind Vane

The wind vane measures wind direction and communicates with the yaw drive to orient the turbine properly with respect to the wind.

2.7.1.2.20 Anemometer

The anemometer measures wind speed and transmits wind speed data to the controller.

2.7.1.2.21 Transformers

Transformers receive AC (alternating current) electricity at one voltage and increase or decrease the voltage to deliver the electricity as needed. A wind power plant will use a step-up transformer to increase the voltage (thus reducing the required current), which decreases the power losses that happen when transmitting large amounts of current over long distances with transmission lines. When electricity reaches a community, transformers reduce the voltage to make it safe and useable by buildings and homes in that community. Every wind turbine has its own transformer for this project (see Figure 10)

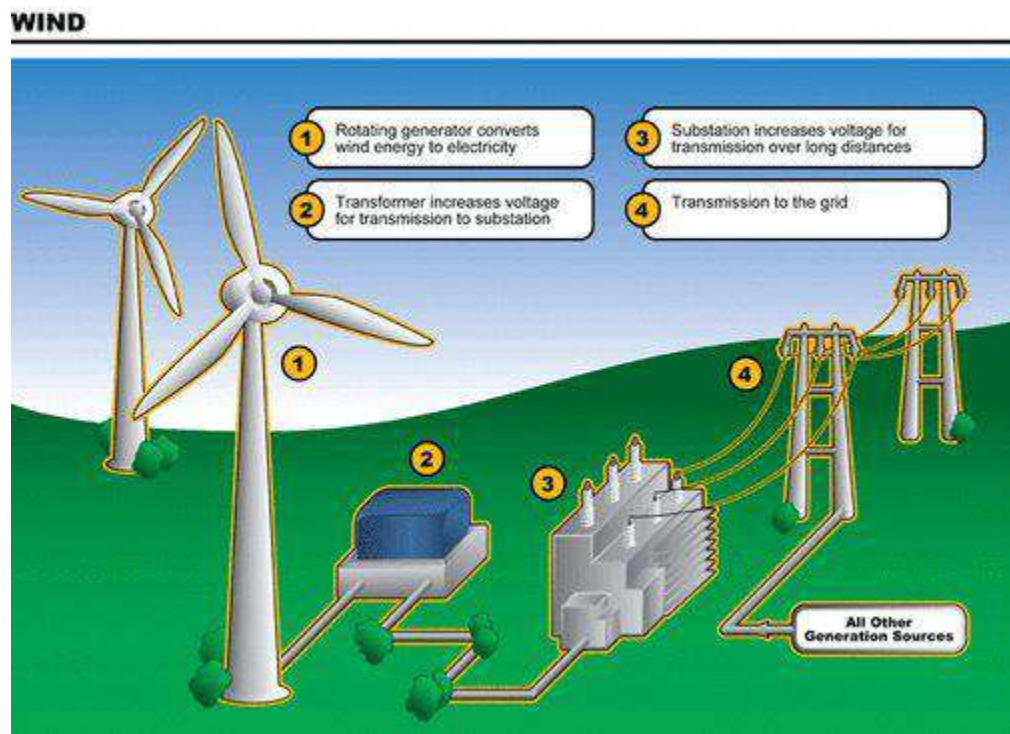


Figure 10: role of transformer in wind plant

2.7.2 Substation

It is predicted to install 12 interconnected substations on the project site. These substations will collect electricity from the wind turbines and convert it to a higher voltage (from 33 kV to 132 kV) that is appropriate with the High Voltage SEC grid.



Figure 11: Typical 33/132kV Substation

2.7.3 Over Head Transmission lines

Overhead transmission lines (132 kV) will collect electricity from on-site substations and transfer it to the High Voltage Line (HVL) passing through the project area (see figure below). This HVL connects three SEC substations which are Starah, Al Haddar and al Ahmar.

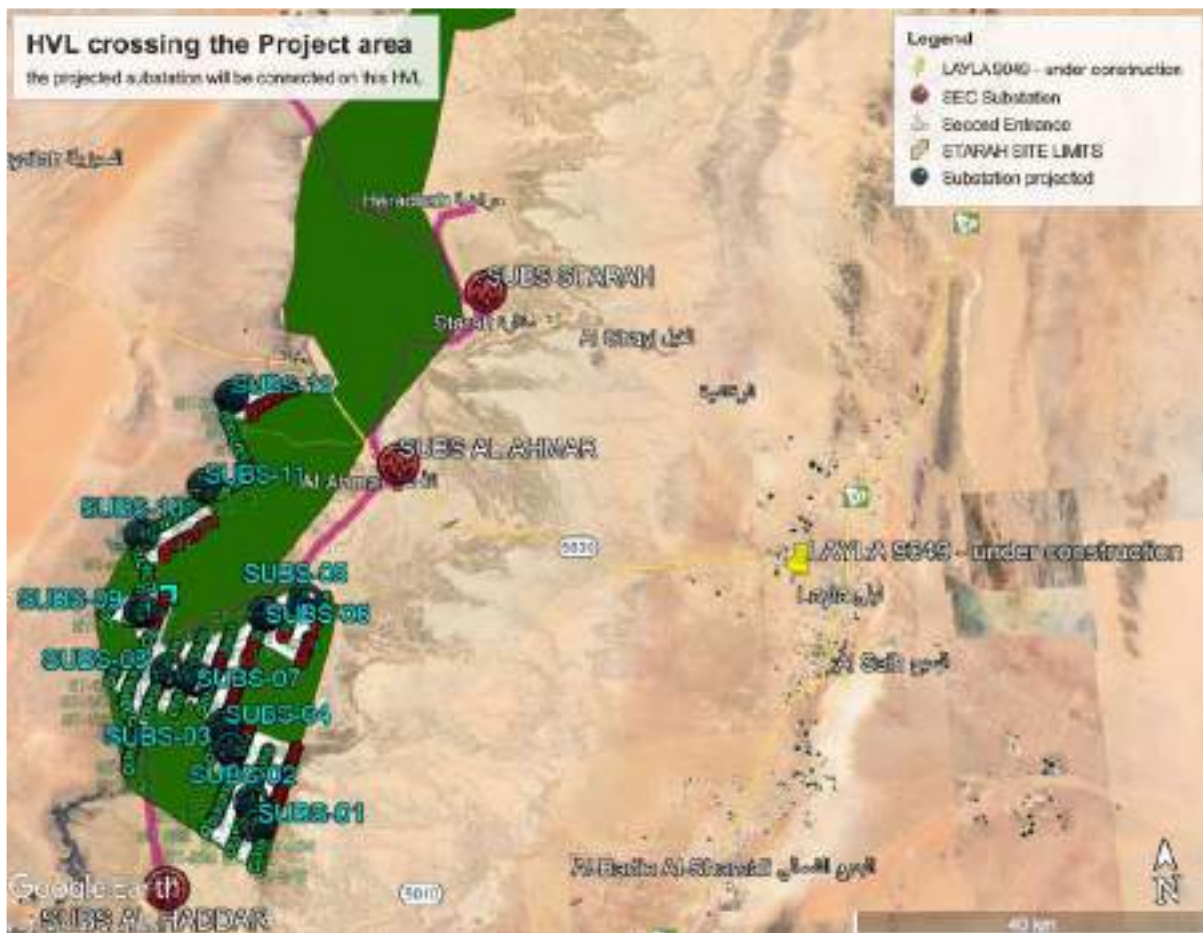


Figure 12: HVL crossing the project site (in pink)

2.7.4 Cabling for turbines interconnexion

The wind turbines and their transformers will be interconnected through medium voltage cables (33kV) to substations located within the Project site. It is likely that the connection between the turbines and the substations will be made using underground transmission cables buried in ground by trenches (about 1 m depth)

2.7.5 Transmission Towers for OHTL

The main component of the OHTL is the transmission towers. The transmission tower will be a three (3) phase steel beam Double-Circuit Transmission Towers (DCT), which will, interconnect substations and transport the electricity from the substations located within the Starah Wind Farm to the High Voltage Line Grid of SEC. The typical structure of the DCT tower is presented in Figure 13 below.

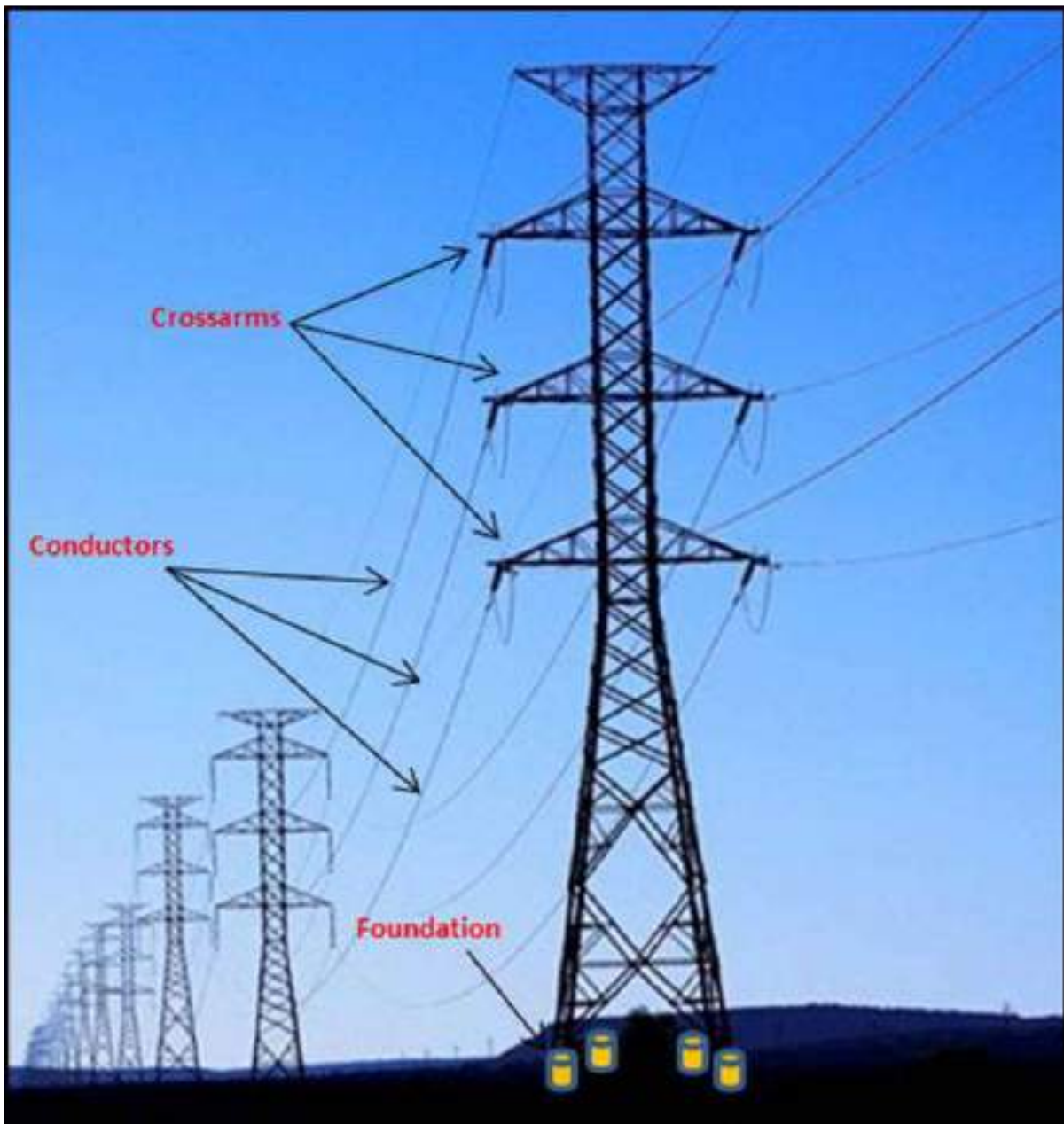


Figure 13: Typical Structural Components of DCT towers

At this stage the exact number of towers that will be distributed throughout the route is not known. The height of each tower will around 50m or more depending on the crossed area topography conditions.

Each transmission tower will consist of the following:

- Foundations: each tower will be fixed and bolted to the ground through reinforced concrete foundations. The exact area for each foundation is not known yet and it will be determined at a later stage as part of the detailed design; and

- Cross-Arms: each tower will have six (6) steel beam cross arms (3 on each side) which connects the conductors (discussed below) with the towers.

2.7.6 Conductors

The conductor is the line used to carry electrical energy from one tower to the next until its connection with the High Voltage National Grid. Number of conductors is not known at this stage of project. The conductor will be likely a 220kV line.

2.7.7 Connection on SEC grid

Voltage level for the interconnection to the electrical grid will be 380 kV, as normalized by SEC. The voltage transformation from the generation to the transmission systems will be made by SEC in a substation to be located inside the limits of the wind plant and oriented to the actual HV substations to facilitate the connections.

As indicated by the MoE, the connections shall be as follows:

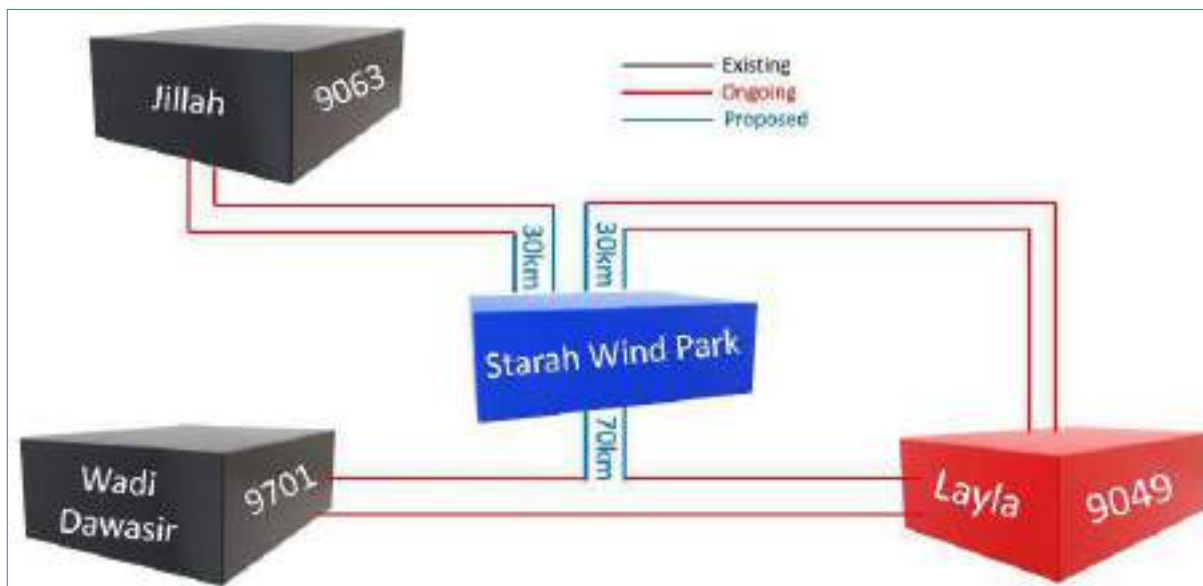


Figure 14: Starah wind plant interconnection

2.7.8 Associated Facilities and Other Plant Infrastructure

Many associated facilities and other plant infrastructure are necessary to carry out the project in the right way. These facilities and infrastructures are described below:

2.7.8.1 crane pads

Next to each wind turbine to accommodate cranes for the installation of the wind turbines and for maintenance activities during operation. The crane pads will be suitable to support loads required for the erection, assembly and operation and maintenance of the turbines.

2.7.8.2 Roads Network

a road network will be required for installation of the turbines during the construction process and for ease of access to the turbines for maintenance purposes during operation.

In order to have a safe component transportation the wind turbine manufacturers define the minimum geometrical requirements of the roads design that should be respected

These requirements are quite demanding compared to, for example, any other type of rural road, but it is worth noting the large size of the components that a wind park requires for its assembly.

2.7.8.3 Building Infrastructure

onsite building infrastructure could be required for the daily operation of the Project. This could include an administrative building (offices) used for normal daily operational related work and a warehouse for storage of equipment and machinery such as spare parts, oil, fuel, lubricants, etc.

2.7.8.4 Temporary Construction Laydown Area

A construction laydown area would be set up. This area would be used for laydown of materials, staging of traffic to avoid congestion, and for the temporary concrete batch plant.

2.7.8.5 Scrap yard

A scrap yard will be present within the site. The scrap yard will consist of discarded spare parts and other hardware components such as wood/steel, oil barrels, wires/cables and domestic components.

2.8 Project footprint

This section provides an estimate on the footprint of the Project taking into account the components discussed in the previous section. The number and figures have been based on preliminary information provided and similar studies on wind farms.

Table 6: Footprint of the Project Components

Component	Footprint	Description
Turbines	0.62 km ²	This includes the footprint for the foundation and the crane pad area for each of the 324 turbines. Each crane pad is likely to be around 1600 m ² in area (40m in width and 40m in length), whereas each foundation is likely to be around 320 m ² in area (20 m diameter of foundation)
Substations, Electrical Specific facilities, offices, control room,	0.58 km ²	Includes footprint of the substation area and all building facilities. (10 acres per substation and approximately 10 ha for all other buildings)

Component	Footprint	Description
Warehouses and Storage facilities		
Trenches for MV cables and communication cables	1.38 km ²	Trenches are likely to be around 230 km in length and a width of around 6m.
Road networks	2.3 km ²	Road network is likely to be around 230 km in length and a width of around 10 m .
Total Project Footprint	4.88 km²	Project footprint is around 1.25 % of the total boundary of the Project area.
Total Project site Boundary Area	390 km²	

As noted in the table above, the total area of disturbance for the project is significantly small and is less than 1% of the Project area (which is 15km²). As discussed earlier, this number is based on preliminary numbers available at this stage and could be subject to change at a later stage of the project development, see Table 5.

2.9 Project schedule

It is scheduled to construct and operate the wind power plant as below.

Table 7: project schedule

Project activity	Duration
construction activities	30 months
Operation and maintenance activities	25 years
Decommissioning	12 months

2.10 Project Phases and Activities

The proposed project plant is currently at initial stages of planning. The activities for the project can be divided into the following phases/stages.

- Planning phase.
- Construction phase.
- Operation and maintenance phase; and
- Decommissioning phase.

The key activities for the above are as showcased in table below **Error! Reference source not found..**

Table 8: Project Phase and Key activities

Phase No	Project phase	Key activities
1	Planning	• Identification of land area and site; • Site surveys as topographic, geo-technical investigations, wind speed and availability and yield study, electrical grid studies, etc.; • Obtaining all necessary approvals/clearances; and • Design and finalization of contractors.
2	Construction	• Contractor mobilization. • Site Preparation including fencing, clearing of bushes, pit filling, levelling and grading; • Construction of site office and internal roads; • Construction of temporary storage facilities; • Foundation laying for ground mounted structures; • Storage of WTGs parts delivery and their installation; • Laying of internal electrical connections; • Construction of substation and office buildings; • Installation of inverter and transformers; • Excavation foundation and erection of transmission line towers; and stringing of transmission lines.
3	Operation and Maintenance	• Cleaning WTGs 1time every 5 years ; • Control of vegetation, weeds, bushes etc. within the site and those immediately surrounding it; • Routine inspection of all WTGs and associated structures, cables, transformers, inverters, mounting structures etc.; • Operation and maintenance of ancillary facilities such as power substation. • Inspection and maintenance of transmission lines; and • Inspection and maintenance of internal pathways and access roads.
4	Decommissioning	• The average life span of the WTGs is 25 years. • At the end of this life cycle, the WTGs will either be revamped or replaced, or disposed as per the then applicable legislation; • If decommissioned, all components including foundations and internal roads of the project will be removed and the site will be restored to its preconstruction state;

Phase No	Project phase	Key activities
		The concrete pedestals of the ground mounted structure foundations will be demolished and removed from the sub-surface.

2.11 Land preparation and construction phase activities

Land preparation and construction activities as well as schedule, workforce and relevant construction machinery equipment are described below.

2.11.1 Schedule

Land preparation, construction and test phase are estimated to last 30 months

2.11.2 Workforce and Workers' Accommodation

Approximately 1100 labours are estimated to be deployed in the peak construction phase for the foundation structural work, fencing, cleaning and erection of mounting structure. The contractor workforce will comprise of both skilled and unskilled labours.

Where possible workforce will be sourced from nearest communities during the project construction phase. Non-local workforce, including unskilled workforce, administrative staff and engineers, will be accommodated at the Camp within the construction laydown area.

2.11.3 Construction Activities

The construction phase activities will include the following key activities

- Land clearing for site preparation and access roads;
- Excavation and filling;
- Transportation of supply equipment, components and materials;
- Construction of foundations, involving excavations and placement of concrete.
- On-site assembly and installation of WTGs;
- Installation of electrical connection systems, including cabling.
- Construction of offices and warehouses;
- Construction of Substations and Electrical Transmission Lines.
- Testing, commissioning and connection to the grid.

Land preparation works will include removal of topsoil, excavations and construction of access roads and backfilling/site levelling where required. Firstly, topsoil will be removed to a depth of 1.5 m then excavation will be carried out.

Given that the total area disturbed by the 5 km² (project footprint), then the total volume of the soil that will be excavated for land preparation is estimated to 7.5 million m³ (1.5 m in average the depth of excavation). All of excavation material will be used for backfilling while 20% of it will be used for levelling on site.

All materials, equipment, and components, such as WTGs and its parts, transformers, ETL towers etc. will be transported to Site via access roads.

Contractor responsible for engineering and material supply, will manage the project logistics, including all material transportation and installation works for Wind Power plant Project.

2.11.4 Construction Machinery and Equipment

Typical list of machinery and equipment to be used for construction activities is provided in Table 9. Electricity required during the construction phase will be supplied from on-site diesel generators.

Table 9: Estimation of Construction Machinery and Equipment used in peak time

Machinery / Equipment	Estimated Maximum Number during Peak Time
Excavator	14
Grader	4
Vibratory Roller	6
Water Sprinkler	6
Loader	4
Backhoe loader	3
Truck	56
Dozer	4
Tractor	7
Crane	7
Diesel generators	7
Mobile Fuel Tanker	1
Lowbed	1
Pick-up Truck	7
Bus	8
Light tower	10
Manitou	21
Rock Machine	3
Colon Pile Driver	10

2.12 Operation and maintenance activities

2.12.1 Project Lifetime

The design lifetime of WTGs is generally 25 years, but in practice WTGs should last longer with proper maintenance.

The Project operation phase will require routine (preventive) maintenance throughout the operation phase to ensure extended system lifetime, as well as compliance with manufacturer warranty and ensure efficiency in energy production.

Routine maintenance activities include regular cleaning of blades and turbine towers (considering the climatic conditions of the region frequent periods may be required), greasing and changing oil of gear boxes and maintenance of electrical components, control equipment and access roads.

2.12.2 Workforce

The maximum number of personnel during peak construction time is estimated to be 1500 personnel. All non-local project staff including technical and administrative staff will be accommodated at the Camp Site that will be installed on site.

For the operation Wind Power plant, the number of 150 personnel is estimated (focusing on number employed in similar projects) to be employed. Non-local operation personnel will be accommodated in project site.

During the operation phase, approximately 10 - 15 employees/technicians of SEC/O&M contractor would be deployed at site. Apart from these, there will be 3-5 staff who will be engaged in housekeeping and approximately 30 are envisaged to be employed as security guards during O&M stage. These figures will be confirmed upon finalization of project components.

2.13 Resource Requirement

2.13.1 Land Requirement

The total land requirement for the 2000 MW Wind Power project is estimated to be approximately 5 km². Breakdown of land requirement for each component (Installation of turbine, Site office, Inverter room, Temporary labour camp, Stock yard and Transmission lines) in details are not available at this stage.

The project does not involve any private agricultural land, any restricted, protected area or private property.

According to the available information and interviews with the official authorities in the region, there are no current or future projects, and no restrictions or constraints on the site.

2.13.2 Water Requirement and Source

2.13.2.1 Water requirement in construction phase

During the project construction phase, water is required for preparing RCC foundations (Reinforced Cement Concrete (RCC)) for WTGs mounting structures, building control room and security rooms, and domestic purpose such as drinking and washing by the construction workers and staff. Water is also used for dust suppression.

2.13.2.1.1 Water requirement for domestic use

General Authority for Statics in The Kingdom has reported in 2017 that has reported that average daily water consumption per capita ranges between 102 L per day per capita (in Jazan) and 381 L per day per capita (in Eastern region). For the project we can take the average value of **150 L** per day per capita. Accordingly, maximum daily water demand is estimated to be **170 m3 per day** for 1100 workers during the peak construction.

Drinking water can be purchased as bottled water from the nearest market. The source of water for other domestic purposes is not known yet at this stage.

Daily wastewater volume generated on site is estimated to be 136 m3/per day if considering a rejection rate of 0.8

2.13.2.1.2 Water demand for dust suppression

According to the up-to-date information gathered from other similar projects, daily water demand for dust suppression varies between 260-320 m3 during dry periods. If we take the average value of **290 m3/day**. The monthly water demand for dust elimination will be **8700 m3/month**.

The source that would supply the water demand for is not fixed yet at this stage of project.

2.13.2.1.3 Water demand for civil works

The total quantity of concrete estimated for civil works in the project is 400,000.00 m3. Considering the value of 150 L of water per cubic meter of concrete. The total water demand for the project is estimated to 60,000 m3.

To this demand, it is approximately added 1600 m3 per month for other miscellaneous civil works.

The total water demand during the construction phase is then 3300 m³ per month.

Water will be brought to project site by tankers.

2.13.2.2 Water requirement in operation phase

2.13.2.2.1 Water for WTGs cleaning

During operation and maintenance phase. Water is used is used in cleaning of WTGs (wet cleaning). Studies indicate that on average a wind turbine should be cleaned every 5 to 7 years to achieve maximum performance. Roughly 5 gallons of water are used to hand-clean a standard 90-meter wind turbine versus 30 gallons with the traditional pressure-washing method.

If we consider a frequency of cleaning of the turbines one time per five years and 30-gallons per turbine for efficient cleaning, then the total amount of water needed is near 8 m³/per year. Water will be brought by tankers

2.13.2.2.2 Water for domestic use

Water will be required for domestic purposes by the operations staff and workers. The daily water demand for the **150** personnel working on site is **23 m³/day**. Considering a rejection rate of 80% the daily domestic wastewater flow rate will be estimated to **18 m³/day**.

2.13.3 Raw Material Requirement

Construction phase

the major raw materials required for the construction phase are fencing material, construction materials like cement, sand, aggregate that will be sourced from local areas. WTGs for the project along with associated structures will imported. The quantity of steel needed for the reinforced concrete is estimated to 32,000.00 MT and the amount of concrete is 400,000.00 m³. (considering 80 kg of steel in 1 m³ of concrete).

Operation and Maintenance phase

There will not be major requirement of raw materials during operation except for maintenance purpose excepted consumable spares.

2.13.4 Power Requirement

Construction Phase

Power requirement during the construction phase will be met through Diesel Generators (DG). It is estimated that 10 D.G. sets of capacity 35 kVA each will be used during construction phase.

The exact number of DG sets to be used, as well as the quantity of fuel, could not be ascertained as the Project is in the planning stages.

Operation Phase

Based on initial assessment, power requirement during daytime would be met through auxiliary generation. During the nighttime power requirement would be met through SEC electricity supply.

DG sets would also be kept at the control room for emergency power backup.

2.13.5 Fire Safety and Security

Construction Phase

Appropriate firefighting system and equipment shall be provided throughout the construction period.

The fire extinguishers will be placed at all strategic locations such as site office, storage yard, near construction area, welding area, etc. Besides this, emergency contact numbers shall also be displayed onsite.

Operation Phase

It is understood that suitable fire protection, fighting systems, portable fire extinguishers, fire buckets and automatic fire detection system will be made available at the entire wind farm area, inverter stations, main control room and switchyard. The aforesaid systems and equipment will conform to National Fire Protection Authority (NFPA), fire safety standards and local fire authority requirements. Firefighting arrangements for electrical utilities like transformers etc. will be in accordance with Saudi firefighting standards in electrical facilities and National Fire Protection Association (NFPA) 70 and 15 requirements.

2.14 Pollution Streams during Construction Phase

Pollution streams during construction phase will include air emissions, wastewater generation and solid waste generation

2.14.1 Solid Waste Generation

Construction Phase

The key solid wastes that are expected to be generated during construction phase are as follows:

- Domestic waste from temporary site office; hazardous waste such as waste oil, lubricants, oil contaminated rags; electronic waste like broken WTGs etc.;
- As a means of best practice, hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and secondary containment. The storage containers/ bins/ drum will be clearly marked and identified for their hazards. Before completion of 90 days, hazardous waste materials will be sent to an authorized vendor for eventual disposal at the Common Hazardous, Waste Treatment, Storage and Disposal Facility.
- Hazardous waste authorized vendor is yet to be identified as the Project is in the planning phase;
- The broken WTGs, batteries (dry type or wet type), electronics if any, will be sent back to the vendor as part of buyback arrangement.
- Domestic solid waste will be disposed with the help of authorized vendor at authorized disposal ground;
- The transformer oil drums will be disposed through an authorized hazardous waste recycler; and
- All non-recyclables waste will be collected and disposed of by the contractor at designated landfill sites.

Operation Phase

During operation phase waste generated from the project will include

- domestic waste at site office, scrap materials like scrap tools, damaged PPEs etc.;
- Hazardous waste like waste oil, lubricants, used transformer oil; damaged batteries; damaged WTGs etc.

Following measure will be adopted for disposal of solid waste:

- The hazardous wastes will be stored temporarily onsite at separate designated covered area provided with impervious flooring and secondary containment and will be disposed in accordance with Hazardous and Other wastes
- The broken WTGs, batteries (dry type or wet type), electronics if any, will be sent back to the vendor as part of buyback arrangement; and
- Domestic solid waste generated from the site office will be disposed at disposal site of the nearest municipality.

2.14.2 Air Emissions

Construction Phase

There will be impact on air quality due to onsite construction activities. The likely emissions from construction activities would include the following:

- Fugitive emissions from site clearing, material handling, transportation, piling, use of construction machinery, etc.;
- Fugitive dust emissions from unpaved roads;
- Vehicular emissions from increased traffic volume from vehicles used for transport of construction material; transportation of WTGss and accessories; and
- Exhaust emissions from operation of diesel generators.

To control air emission during construction phase from operation of D.G. sets, adequate stack height as per national standards will be provided to ascertain regulatory compliance. Fugitive dust emission arising from various activities such as piling, transportation of material (loading and unloading), vehicular movement (on unpaved roads) will be minimized through sprinkling of water and maintaining vehicular speed to 10-15 km/hr. Vehicular emission will be controlled through proper maintenance of vehicles.

Operation Phase

Under normal operating conditions there would be no gaseous emissions from the operating areas.

However, there is a likelihood of gaseous and fugitive dust emissions, in smaller concentrations, owing to the operating of maintenance vehicles. As a means of best practice and adherence to national regulations, well maintained vehicles will be used for operation and maintenance purposes.

2.14.3 Waste Generation

Construction Phase

Liquid effluents generated during the construction phase will include domestic sewage from temporary site office. As part of the site preparation stage, a drainage and sewerage system will be constructed for the site office. The sewerage system will consist of soak pits for the collection of wastewater from the kitchen and washing areas and Office facility. Sewage from the toilets will go into lined septic tanks. Sewage disposal trucks will be used to periodically remove the sludge/sewage from the site.

Operation Phase

The operational phase will have negligible wastewater generation at site office. Septic tank and soak pits will be provided at the site office for disposal of sewage.

2.14.4 Noise Emissions

Construction Phase

During the construction phase noise will be generated primarily during the daytime. Noise will be generated from piling, moving vehicles as well as construction equipment and machineries, including the DG sets utilized for power. Since there are no settlements in the near vicinity of the construction site, the receptors of noise pollution will be only the construction workers. As a control measure it will be ensured that noise emission from the vehicles and equipment's shall not exceed 91 dB(A). DG sets will be provided with acoustic enclosures and workers near noise generating machines will be provided with earplugs as safeguard against high noise hazards.

Operation Phase

Under normal operations, none of the activities of Wind Power plant will generate noise. Any activities generating from maintenance work will be restricted to daytime only.

3. PROJECT ALTERNATIVES

3.1 Methodology for selecting and evaluating alternatives

This step aims to describe the proposed alternatives for the project and determine the most appropriate and least impactful on the environment. This step includes a study and analysis of many technical aspects of the project, including the location and design of the project and the technology used in the operation process. The alternatives evaluation methodology is based on making a comparison between the various proposed alternatives for the project and comparing the following aspects:

- Proposed project site alternatives,
- Economic feasibility and associated costs,
- The pros and cons of each alternative,
- Financial efficiency, including costs, environmental management,
- The degree of impact on the environmental, economic and social aspects,
- Technology used and possible project designs,
- Consistency and not conflict with future development plans in the region,
- Possible build and run processes,
- Consumption of natural resources, especially energy and water,
- Administrative, legal and technical difficulties associated with the implementation of each alternative,
- Risks related to the implementation of each alternative.

Various alternatives will be studied, with the aim of eliminating or reducing the impact to an acceptable degree. All available alternatives will be presented and include:

- No-project alternative
- Technology alternatives.
- Site alternatives.

3.2 No-project Option

The no-project alternative represents the option of not undertaking the proposed activity or any of its alternatives. It provides the baseline against which the predicted impacts and risks can be assessed. Although the no-project alternative would not result in any environmental impacts on the site or surrounding area, it would also not bring any positive impact to the local area in terms of socio-economic benefits, job creation and skills development. The local area will not benefit from economic benefits associated with the Saudi Arabia's National Renewable Energy Program (NREP) and investment in socio-economic development.

The no-project alternative will not contribute to the Saudi Arabia's long-term strategy of diversifying energy mix and will not reduce the Kingdom's dependence on oil and gas and its

greenhouse gas emissions as part of the Paris Agreement. It will also reduce chances to create jobs and limit economic development in the region, and then opposes Vision 2030’s goals.

Although the predicted negative impacts of the proposed activities (e.g. vegetation clearance, disturbance of habitat, noise and dust generation, etc) would not occur on the proposed site, the no-project alternative may result in other and less environmentally friendly land uses to be developed on the site.

Based on the evaluation of the no-project alternative, it seems most likely that the overall positive impacts of the proposed activities would outweigh negative impacts if the proposed mitigation measures and management actions are implemented. The project would help to diversify the local economy and result in significant positive economic spin-offs primarily because of the expenditure injection and jobs associated with it. Risks and negative impacts would primarily arise at a local scale and site level and will be managed and controlled if the recommendations made are well followed.

3.3 Alternative Technologies

Harnessing wind energy is an eco-friendly process, with an inexhaustible wind resource and minimal pollution. There are minimal fuel requirements for operational activities. Wind energy has a short development timeframe, more predictable energy output and low maintenance costs as compared to some other forms of renewable energy sources. Table 7 elaborates upon the environmental advantages and disadvantages of various power generation systems.

Table 10: Advantages and Disadvantage of Power Generation Systems

System	Advantage	Disadvantage
Thermal Power	• Large-scale production potential • Moderate gestation period • Wider distribution potential • GHG emission estimated as low as 1.1gCeq/kWh for run of river projects • Do not create any waste by-products during conservation process. • Some hydropower facilities can quickly go from zero power to maximum output because hydropower plants can generate power to the grid immediately, they provide essential backup power during major electricity outages or disruptions	• High fossil fuel consumption • Large quantities of water required for cooling • High volume of emissions from operation • Accumulation of fly ash (in case of coal powered installations) • The upstream impact from mining and oil exploration. • GHG emissions estimated as 228gCeq/kWh • Site-specific, dependent on reservoir/river etc. • Long gestation period • Alteration of river flow regime • Adverse social and ecological impacts due to inundation and downstream effects.
Nuclear Power	• GHG emissions as low as 2.5gCeq/kWh. • Low fuel cost • The production of electric energy is continuous. A nuclear power plant generates electricity for almost 90% of the annual time. It reduces the price volatility compares to other fuels; • Do not emit smoke particles or gases.	• Availability of fuel source; • Hazards associated with radioactive materials • Disposal of waste is expensive as wastes are radioactive in nature • High cost of project; • Long gestation period; • Risk of fallout and meltdown scenarios and its impacts on the local population and environment
Wind Power	• Pollution levels are insignificant. • Inexpensive power generation; • Inexhaustible wind resource; • GHG emissions as low as 2.5Ceq/kWh for the production chain	• Bird and Bat hit issues in certain areas. • Site-specific, dependent on wind pattern; • Expensive installation • Large land requirement; • Site-specific, dependent on wind availability and speed
	• Pollution levels are insignificant; • Inexpensive power generation; • Inexhaustible wind resource; • GHG emissions as low as 8.2gCeq/kWh for the production chain.	

Source: International Atomic Energy Agency (IAEA)

3.4 Site alternatives

Wind Power project are non-polluting energy generation projects which are site-specific and dependent on the availability of windy zones. Project site identified for the proposed wind farm and its final selection was based on the availability of a contiguous patch of land and no settlement on the same.

- No settlement present in the project site;
- The project site land is predominantly government land allocated to the MoE.
- The project site land is medium highland and has no agricultural value.
- The proposed project site has the following location advantages:
- Site with high wind ;
- No ecological sensitive receptor such as national parks, Wildlife Sanctuary within 10 km radius;
- No cultural property of archeological importance within 5 km radius and
- Power evacuation infrastructure i.e national grid substation is within from the proposed site.

4. POLICY, INSTITUTIONAL AND LEGAL FRAMEWORK

4.1 Overview

this section explains the legislative basis for the proposed project outlined in the ESIA Report and outlines the following information:

- National environmental law & regulation
- IFC / EP requirements

It provides a summary of the environmental legislative framework relevant to the Kingdom of Saudi Arabia. The legislation, guidelines and standards relevant to the development are used as a basis for screening and evaluating the development’s impacts. These guidelines and standards are presented as a summary. The full and most recent legislation will be consulted prior to undertaking the assessment and the implementation of any mitigation or monitoring plans.

The main environmental regulator with responsibility for the terrestrial environmental management of Kingdom of Saudi Arabia’s (KSA) is the Ministry of Environment, Water and Agriculture (MEWA).

The National Center for Environmental Compliance (NCEC) is concerned with preserving and protecting the environment, preserving its resources, and preserving it from deterioration, by providing high-quality services that contribute to raising the level of compliance with environmental regulations and standards.

4.2 National regulatory framework

The KSA Law on Environment Impact Assessment and law supporting regulations defines the legal requirements for the EIA procedure.

The first comprehensive Saudi Arabian national environmental legislation was enacted on September 24, 2001, in the form of the General Environmental Regulation, Council of Ministers Resolution No. 193. It entered into force on October 31, 2002, and its implementation rules were published on September 30, 2003.

4.2.1 The Basic Law of Governance

The Basic Law (Royal Decree No. A/90) is commonly referred to as the Constitution of Saudi Arabia. Article 32 of the Basic Law states: “The State works for the preservation, protection and improvement of the environment and for the prevention of pollution”.

4.2.2 Public Environment Law 2001 (PEL)

The Public Environmental Law (PEL) was enacted by Royal Decree No.M/34 dated 28/7/1422 H (corresponding to 16 October 2001) and established the general regulatory framework for the development and enforcement of environmental rules and regulations in the Kingdom of Saudi Arabia. Under this law the General Authority for Meteorology and Environment protection (GAMEP), previously the Presidency of Meteorology & Environment (PME) has been assigned

with the responsibility for the development and enforcement of environmental rules and regulations.

The GAMEP is therefore responsible for:

- Conducting environmental studies.
- Documenting and publishing the results of any environmental studies.
- Preparing, issuing and reviewing relevant environmental standards.
- Ensuring compliance with relevant environmental standards.
- Working in conjunction with other governmental agencies, establishing plans to deal with environmental disasters.
- Promoting general awareness for the protection of the environment.
- Environmental monitoring.
- Updating of environmental standards.

4.2.3 General Environmental Regulations and their Rules for Implementation (GERRI)

The General Environmental Regulations and Rules for Implementation were enacted in October 2001 and under this law GAMEP is responsible for issuing consent for projects to ensure compliance with the Public Environment Law and implementing regulations. Under this regulation, any licensing authority must ensure that an ESIA is prepared for any project that may have a negative environmental impact.

In respect to the completion of environmental assessments, particular reference should be made to the GERRI (2001) articles presented in Table below.

Owners of “projects”, which are defined as utilities and facilities which may have an effect on the environment, are required to comply with existing and future environmental specifications, standards, measurements and guidelines as promulgated by the General Authority for Meteorology and Environment Protection (GAMEP) previously the Presidency of Meteorology & Environment (PME) and set out in the appendices of the Implementing Rules. Moreover, prior to the setting up of a project, an environmental impact assessment study must be completed and approved by GAMEP.

The detail of the legislation is contained in the appendices of the Implementing Rules, as follows:

- **Appendix 1:** Environmental Protection Standards.
- **Appendix 2:** Fundamentals and Standards for the Assessment of Environmental Effects of Industrial and Development Projects.
- **Appendix 3:** Guide to Environmental Accreditation Procedures.
- **Appendix 4:** Hazardous Waste Control Rules and Procedures.
- **Appendix 5:** National Contingency Plan for Combatting Marine Pollution by Oil and other Harmful Substances in Emergency Cases.

➤ **Appendix 6: All Types of Violations and Penalties.**

4.2.4 GAMEP (NCEC) Environmental Standards

The GERRI were enacted in October 2001, and Appendix 1 of GERRI outlines the Environmental Protection Standards relevant to facilities in the Kingdom of Saudi Arabia. The GAMEP (2001) General Environmental Protection Standards for New Facilities (Article 7) are outlined as:

- All new major facilities as well as major modifications to existing facilities shall be designed, operated and maintained so as to avoid exceedances of the ambient environmental standards as promulgated for the Kingdom of Saudi Arabia at the time of approval of the design.
- Each new major facility or major modification of an existing facility shall incorporate the best available technology for control of pollutant discharges and for the disposal of wastes resulting from the operation of the facility.
- All new facilities and modifications of an existing facility shall be designed and operated so as to avoid the discharge of any toxic substance, whether specifically regulated or not, in sufficient quantities to be harmful to public health.

In 2012, the GAMEP developed several draft supplementary Environmental Standards revising in part the General Standards for the Environment issued by the GAMEP in Appendix 1 to the GERRI. These Standards are listed in Table below.

Table 11 : GAMEP Environmental Standards

GAMEP Environmental Standard (GAMEP-ES)	Topic
GAMEP ES 1	Material Recovery & Recycling
GAMEP ES 2	Mobile Source Emissions
GAMEP ES 3	Noise
GAMEP ES 4	Air Emissions for Stationary Sources
GAMEP ES 5	Prevention of Major Accidents
GAMEP ES 6	Storage and Material Reclamation Facilities Design and Operation
GAMEP ES 7	Thermal Treatment and Incineration Design and Operation
GAMEP ES 8	Waste Acceptance Criteria
GAMEP ES 9	Waste Classification
GAMEP ES 10	Drinking Water Quality
GAMEP ES 11	Biological Treatment Design and Operation
GAMEP ES 12	Waste Control

GAMEP Environmental Standard (GAMEP-ES)	Topic
GAMEP ES 13	Waste Handling and Storage
GAMEP ES 14	Waste Training
GAMEP ES 15	Waste Transportation
GAMEP ES 16	Landfill Design
GAMEP ES 17	Industrial and Municipal Wastewater Discharges
GAMEP ES 18	Best Practicable Environmental Option for Waste Disposal
GAMEP ES 19	Ambient Air Quality
GAMEP ES 20	Ambient Water Quality

4.2.5 Environment Law, promulgated by Royal Decree No. (M/165) dated 11/19/1441 AH

The first comprehensive Saudi Arabian National Environmental legislation was enacted on 2001 in the form of the General Environmental Regulation. It entered into force on 2002, and its Implementing Rules were published on 2003. The Environment Law, promulgated by Royal Decree No. (M/165) dated 19 Dhu al-Qadah 1441 AH (corresponding to 10 July 2020) entered into force on January 2021, superseding the 2001 Regulation.

Under the General Environmental Regulation, the Presidency of Meteorology and Environment (the PME), was charged with the general supervision of environmental affairs in Saudi Arabia and had the responsibility of granting environmental permits. In 2019, the PME’s functions and responsibilities were transferred to four Centres for the environment sector development: The National Centre for Environmental Compliance (NCEC), the National Centre for Vegetation Cover and Combating Desertification, the National Centre for Wildlife and the National Centre for Meteorology. **The Ministry of Agriculture was renamed to the Ministry of Environment, Water and Agriculture (MEWA) in 2016, and now handles responsibilities related to environmental sustainability as well.**

The current Environment Law has granted the National Centre for Monitoring Environmental Compliance with full powers to assume the responsibility of protecting the environment in the Kingdom of Saudi Arabia and to issue environmental standards and guidelines, including environmental legislation and standards for various industrial and construction activities. This Law consisting of 49 articles divided into 9 Chapters aims at protecting the environment, its development and sustainability, adherence to environmental principles, and the regulation of the environment sector and related activities and services.

According to Article 8 of the Environmental Law, both the authorized person and the licensee who engage in activities that may emit emissions or pollutants, or that may affect the

environment; commit to the following environmental requirements, controls, procedures, and standards; determined by the regulations:

- Take the necessary actions and measures when approaching the environmental standards exceedance as specified by the regulations.
- Develop programs and devices to monitor, measure and control the quality of environmental media, in accordance with the regulations.
- Provide the competent authority - on a regular basis - with data and reports related to emissions or pollutants emanating from its activities; To review and conform them, and to identify violations of standards, and requirements, in accordance with what is specified by the regulations.
- Provide the competent authority with an environmental audit study, as determined by the regulations.
- Rehabilitate environmental environments degraded as a result of the exercise of its activities, as determined by the regulations.

Finally, the Environment Law, after its entry into force, cancels the following Regulations, among others:

- Regulation of Saudi Wildlife Authority, issued by Royal Decree No. (M/22) dated 12/09/1406 AH
- Regulation of Trade in Endangered Wildlife and their products, issued by Royal Decree No. (M/9) dated 03/06/1421 AH
- General Regulations for the Environment, issued by Royal Decree No. (M/34) dated 28/07/1422 AH (GERRI 2001). [NOTE: *As an exception to sub-paragraph of GERRI, the provisions relating to waste contained in the General Environmental Regulation - issued by Royal Decree No. (M/ 34) dated 7/ 28/ 1422 AH - continue until the issuance of its provisions and work accordingly*]
- Law of Protected Areas for Wildlife, issued by Royal Decree No. (M/66) dated 19/10/1436 AH

The Environmental Law is implemented through **Executive Regulations** in different areas including:

- Environmental Inspection and Audit.
- Ozone-depleting Substances and Carbon Compounds.
- Environmental Permits for Establishment and Operation of Activities.
- Environmental Rehabilitation for Degraded Sites and Remediation of Polluted Sites
- Prevention and Treatment of Soil Pollution
- Air Quality
- Control of Violations and Imposition of Penalties
- Noise

- Environmental Services Providers
- Protection of Aquatic Environments from Pollution
- Trade in Wildlife and their Products and Derivates

4.2.6 Law of Antiquities, Museums and Urban Heritage promulgated by Royal Decree M/3 dated 9/1/1436 AH

This law states in Article 9 that:

- Archaeological and urban heritage sites shall be preserved when carrying out projects for planning, expansion, or improvement of urban or rural areas. In addition, easement rights shall be taken into consideration, including designation of construction-free areas, in coordination with the Ministry of Municipal and Rural Affairs. Planning projects, in which, or in the vicinity of which, there are archaeological and urban heritage sites, may not be adopted without the approval of SCTA (Saudi Commission for Tourism and Antiquities).
- Licenses for construction or renovation in areas adjacent to archaeological and urban heritage sites may not be issued without SCTA's agreement

In Article 24 it is stated:

1. Activities may not be carried out within the limits of archaeological and urban heritage sites without the prior approval of SCTA:
 - a) Whole or partial demolition.
 - b) Utility, communication, and road works, as well as any activity or process that may change the physical appearance of the archaeological and urban heritage sites, or buildings thereon, or disturb their archaeological layers.
 - c) New construction or landscaping projects.
2. SCTA shall respond within 60 days from the date of receipt of the application for performing any of the activities set out in paragraph 1 of this Article.
3. Activities set out in paragraph 1 of this Article shall be subject to SCTA's control.
4. SCTA shall, in coordination with the Ministry of Interior and the Ministry of Municipal and Rural Affairs, develop technical and procedural mechanisms for dealing with any dilapidated heritage buildings.

4.2.7 The executive regulations

These Executive Regulations are approved by Ministerial Decision of the Minister of Environment, Water and Agriculture and based on Article 48 of the Environmental Law and Cabinet Resolution No. (729) dated 16/ 11/1441 AH. The following is a brief description of the Regulations that are mainly applicable to the project:

4.2.7.1 Executive Regulations for Environmental Permits for Establishment and Operation of Activities

According to the Executive Regulations for Environmental Permits for Establishment and Operation of Activities, the provisions of this Regulations shall apply to all persons who own or operate any activity that has an environmental impact (new or existing) within the territory of the Kingdom including establishment, modification, addition, expansion or closure.

The National Centre for Environmental Compliance is entrusted with the following tasks:

- Issuing technical standards and controls related to environmental impact assessment studies in coordination with the competent environmental centres.
- Receiving and reviewing environmental classification forms and environmental impact assessment studies and issuing relevant decisions.
- Issuing up-to-date indicative lists to classify the various activities in accordance with the provisions of the regulation.
- Defining and approving the rules, conditions and controls related to environmental permits and licenses.
- Carrying out field visits to the sites required to be authorized, when needed.
- Monitor the implementation of the environmental management plan during all phases of any environmentally authorized activity.
- Request and review self-monitoring reports during construction and operation processes.
- Issuing and renewing environmental permits and licenses and collecting the fees specified for them.
- Monitoring and supervising the implementation of the requirements of environmental permits and licenses.
- Inspection, monitoring and detection of violations of these Regulations; Coordination with the competent authority at the Ministry of Interior when needed with regard to the work of arresting violators.
- Coordination with other national environmental centres whenever the activity or studies presented are related to the competencies or powers of these centres.
- Coordination with laboratories, scientific and research centres and experts whenever the need arises when reviewing environmental impact assessment studies.
- Ensure that all environmental impact assessment studies, analyses, tests and environmental measurements contained in these studies are provided by a service provider licensed by the Centre.

The NCEC categorizes or revises the classification of activities according to environmental impacts into categories specified in this regulation as follows:

- Type and volume of activity.
- Energy used.

- Activity depletion of natural resources.
- Land uses.
- Sensitive receptors in areas surrounding the activity.
- The characteristics of environmental impacts, including:
- The nature of the effects (negative or positive, direct or indirect, cumulative...etc).
- The range of the effects.
- Duration of effects.
- The ability of effects to be reversible and return to normal before effects.
- The possibility of effects.
- Level/level of impacts (global - regional - local).

The head of the Centre shall issue updated indicative lists to classify the various activities in accordance with the provisions of the regulations.

Activities are classified into three categories according to the environmental impacts resulting from them and accordingly, their need to conduct an environmental impact assessment study or not. This classification shall be as follows:

- First category: Activities that are expected to cause minimal impacts on the environment that do not exceed the limits of the activity site.
- Second category: Activities that are expected to cause moderate impacts on the environment through the different phases of the activity and these effects can be reduced and controlled and they do not significantly exceed the limits of the activity site.
- Third category: Activities that are expected to cause significant environmental and social impacts. These impacts exceed the boundaries of the activity site and may negatively affect the sustainability of sensitive areas and receptors.

Referring to the Environment Law, promulgated by Royal Decree No. (M/165) dated 19 Dhu al-Qadah 1441 AH (corresponding to 10 July 2020) and based on NCEC decision the Wind Power plant of Starah project is classified as a Category Three which calls for a comprehensive environmental impact assessment.

An environmental permit will be required before starting any construction or modification of the activity and to operate before operating or practicing any activity.

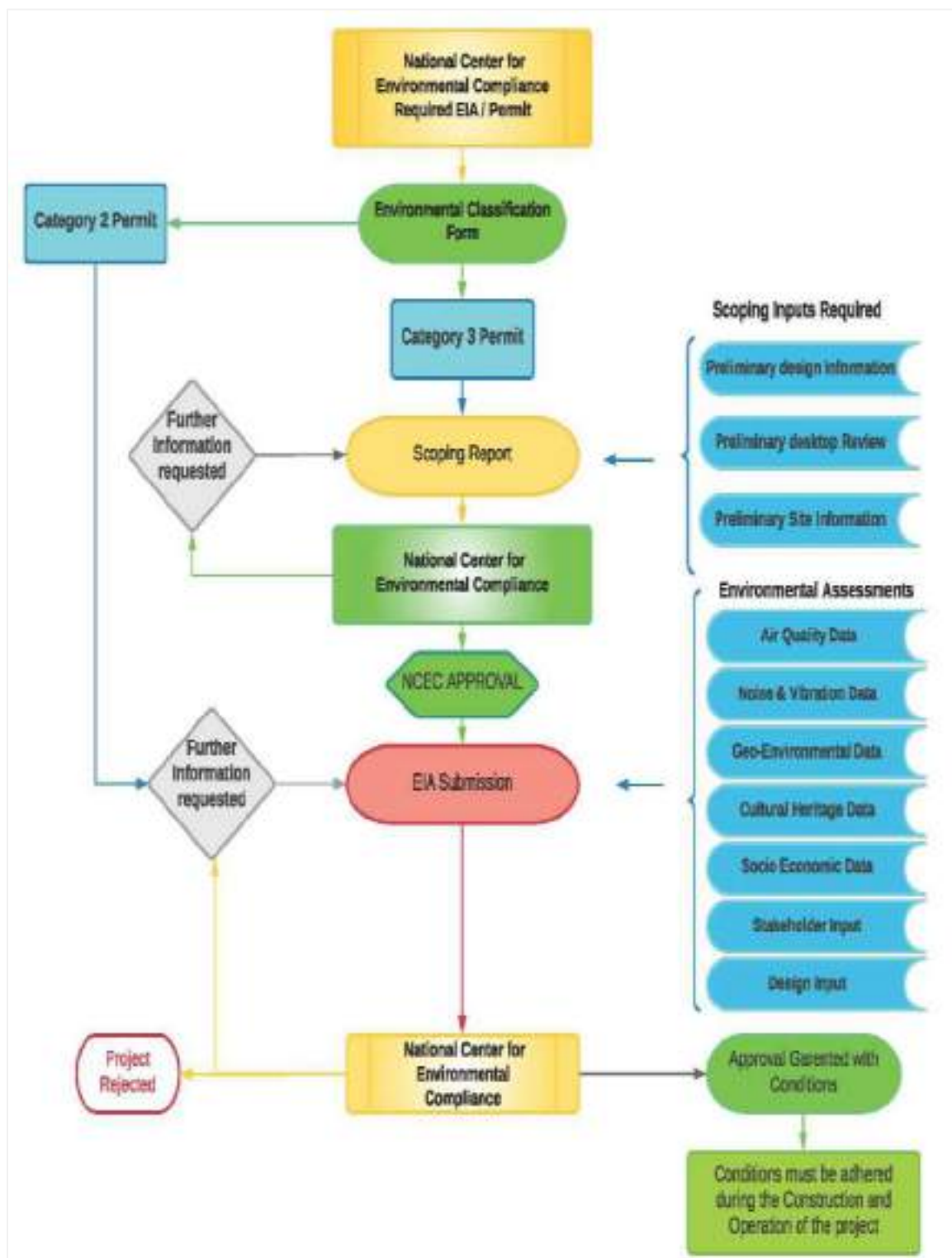


Figure 15 : NCEC EIA Flow process

4.2.7.2 The executive regulation for Environmental Inspection and Audit

According to the Executive Regulations for Environmental inspection and audit, the provisions of this Regulations shall apply to all persons who own or operate any activity that has an

environmental impact (new or existing) within the territory of the Kingdom including establishment, modification, addition, expansion or closure.

The National Centre for Environmental Compliance is entrusted with the following tasks:

- Preparing the methodology for environmental inspection for different activities based on the international best practices
- Prepare and implement an annual environmental inspection plan
- Inspect, control and penalties
- Inspection, Control and Detecting violations of the environmental law or executive regulations and coordinating with the competent authority at the Ministry of Interior when needed with regard to security monitoring work and arresting violators
- Reviewing people's environmental self-inspection reports and ensuring environmental compliance and the effectiveness of approved self-inspection programs
- Preparing requirements and controls related to environmental audit studies
- Reviewing reports of environmental audit studies and issuing relevant decisions
- Follow up the commitment of people to implement what is stipulated in the environmental self-inspection reports, environmental audit study reports, and action plans to implement corrective measures
- Issuance of environmental compliance certificates
- Coordination with other national environmental Center when needed with regard to inspection work whenever the submitted reports and plans are related to the competencies or powers of these Center.

Environmental inspection are classified into 5 categories. This classification shall be as follows:

- 1- Periodic inspection: It is carried out in accordance with the annual plans for environmental inspection in order to verify compliance with the rules and regulations and requirements of licenses and permits.
- 2- Environmental emergency inspection: It is carried out after the occurrence of any emergency to ensure that all corrective and precautionary measures have been taken.
- 3- Inspection to verify the validity of reports and data: It is carried out to verify the correctness of the information provided through reports and data submitted to the center
- 4- Inspection upon receiving environmental complaints or communications: Execution is carried out after receiving complaints or reports to the center and based on what the center decides that the complaints or communications require inspection.
- 5- Inspection in partnership with the relevant authorities: In the event of the formation of committees from several specialized bodies working to study any cases related to the environment sector, emergency or environmental disaster related to all participating parties, or at the request of the supervisory authority.

The center conducts the inspection by sending specialized inspectors to:

- review records and data and keep copies of them
- Take pictures for documentation
- Carry out any operations required for inspection/examination/measurement/or testing
- Take samples of materials / soil / water.
- Ensure that the environmental management plan is implemented
- Detecting violations and taking action
- Document the results of the inspection process and providing companies with a copy of it to take the necessary corrective measures

Environmental auditing

According to the Executive Regulations for Environmental inspection and audit, both the authorized person and the licensee who engage in activities that may emit emissions or pollutants, or that may affect the environment; commit to provide the competent authority with an environmental audit study, as determined by the regulations in case of renew the environmental permit to construct or to operate or if required from the center.

4.2.7.3 The Executive Regulation for Control of Violations and Imposition of Penalties

This regulation sets out the method and procedures for detecting violations of environmental law and regulations, investigating, and proving them by the inspectors. They may request assistance and support from the security authorities when needed.

Anyone who violates the obligations of law or regulations, as indicated in the penalties tables attached to the regulations, shall be punished.

The violator must remove the consequences of the violation and rehabilitate the environment in accordance with the requirements and standards set by the competent authority (Violations are seized by writing a seizure report that includes information on the location, date, details, time of seizure, the names of the violators, their nationalities, and their identification numbers, ...etc.)

4.2.7.4 The Executive Regulation for Prevention and Treatment of Soil Pollution

The Executive Regulations for Prevention and Treatment of Soil Pollution establish the provisions related to soil and its protection from pollution Including preventive measures to prevent pollution and treat soil after pollution. They include “Standards for protecting soil from pollution” in its Annex (1). The table included in Annex 1 is shown below:

Table 12 : Standards for protecting soil from pollution

Parameter	Unit	Value
PH	PH Unit	8,5
Cyanide (free)	mg/kg	8
Fluoride	mg/kg	2,000

Parameter	Unit	Value
Sulphur (elemental)	mg/kg	500
Metals		
Antimony	mg/kg	40
Arsenic (inorganic)	mg/kg	26
Barium (non-barite)	mg/kg	2,000
Barite - Barium	mg/kg	140,00
Beryllium	mg/kg	8
Boron (Standard Phase extract)	mg/kg	5
Cadmium	mg/kg	22
Chromium (Hexavalent)	mg/kg	1,4
Chromium (Total)	mg/kg	87
Cobalt	mg/kg	300
Copper	mg/kg	91
Lead	mg/kg	600
Mercury (Inorganic)	mg/kg	50
Molybdenum	mg/kg	40
Nickel	mg/kg	89
Selenium	mg/kg	2,9
Silver	mg/kg	40
Thallium	mg/kg	1
Tin	mg/kg	300
Uranium	mg/kg	300
Vanadium	mg/kg	130
Zinc	mg/kg	360
Organic		
Benzene (C ₆ H ₆)	mg/kg	0,046
Toluene (C ₇ H ₈)	mg/kg	0,52
Ethylbenzene	mg/kg	0,073
Xylenes	mg/kg	0,99
Styrene	mg/kg	0,68
F1 (C ₆ to C ₁₀)	mg/kg	640
F2 (C ₁₀ to C ₁₆)	mg/kg	520
F3 (C ₁₆ to C ₂₄)	mg/kg	4,300
F4 (C ₂₄ to C ₅₀)	mg/kg	10,000
Acenaphthene (C ₁₂ H ₁₀)	mg/kg	0,32
Anthracene (C ₁₄ H ₁₀)	mg/kg	0,0046
Fluoranthene (C ₁₆ H ₁₀)	mg/kg	0,032
Fluorene (C ₁₃ H ₁₀)	mg/kg	0,29

Parameter	Unit	Value
Naphthalene (C ₁₀ H ₈)	mg/kg	0,014
Phenanthrene (C ₁₄ H ₁₀)	mg/kg	0,051
Pyrene (C ₁₆ H ₁₀)	mg/kg	0,034
Carcinogenic (PAHs)	mg/kg	1
Benz[a]anthracene (C ₁₈ H ₁₂)	mg/kg	0,07
Benzo[b+j]fluoranthene	mg/kg	
Benzo[k]fluoranthene (C ₂₀ H ₁₂)	mg/kg	
Benzo [a]payrene (C ₂₀ H ₁₂)	mg/kg	0,7
Chrysene (C ₁₈ H ₁₂)	mg/kg	
Vinyl chloride (C ₂ H ₃ Cl)	mg/kg	0,014
1,1-Dichloroethene (C ₂ H ₃ Cl ₂)	mg/kg	0,15
Trichloroethene (Trichloethylene, TCE)	mg/kg	0,054
Tetrachloroethene (C ₂ Cl ₄)	mg/kg	0,26
1,2-Dichloroethane (C ₂ H ₄ Cl ₂)	mg/kg	0,15
Dichloromethane (Methylene chloride)(CH ₂ Cl ₂)	mg/kg	0,1
Trichloromethane (Chloroform)(CHCl ₃)	mg/kg	0,0029
Tetrachloromethane (Carbon tetrachloride)(CCl ₄)	mg/kg	0,027
Dibromochloromethane (CHBr ₂ Cl)	mg/kg	0,91
Chlorobenzene (C ₆ H ₅ Cl)	mg/kg	0,61
1,2-Dichlorobenzene (C ₆ H ₄ Cl ₂)	mg/kg	0,097
1,4-Dichlorobenzene (C ₆ H ₄ Cl ₂)	mg/kg	0,051
1,2,3-Trichlorobenzene (C ₆ H ₃ Cl ₃)	mg/kg	0,26
1,2,4-Trichlorobenzene (C ₆ H ₃ Cl ₃)	mg/kg	0,78
1,3,5-Trichlorobenzene (C ₆ H ₃ Cl ₃)	mg/kg	1,9
1,2,3,4-Tetrachlorobenzene (C ₆ H ₂ Cl ₄)	mg/kg	0,042
1,2,3,5-Tetrachlorobenzene (C ₆ H ₂ Cl ₄)	mg/kg	0,37
1,2,4,5-Tetrachlorobenzene (C ₆ H ₂ Cl ₄)	mg/kg	0,19
Pentachlorobenzene (C ₆ HCl ₅)	mg/kg	3,7
Hexachlorobenzene (C ₆ Cl ₆)	mg/kg	3,6
2,4-Dichlorophenol (C ₆ H ₄ Cl ₂ O)	mg/kg	0,0029
2,4,6-Trichlorophenol (C ₆ H ₂ Cl ₃ OH)	mg/kg	0,19
2,3,4,6-Tetrachlorophenol (C ₆ H ₃ Cl ₄ O)	mg/kg	0,039
Pentachlorophenol (C ₆ HCl ₅ O)	mg/kg	0,024
Dioxins & Furans	mg/kg	0,000004
Polychlorinated biphenyl (PCBs)	mg/kg	33
Aldicarb (C ₇ H ₁₄ N ₂ O ₂ S)	mg/kg	0,041
Aldrin (C ₁₂ H ₈ Cl ₆)	mg/kg	5,9
Atrazine and metabolites	mg/kg	0,0077

Parameter	Unit	Value
Azniphos-methyl (C10PN3H12S2O3)	mg/kg	0,41
Bendiocarb (C11H13NO4)	mg/kg	0,14
Bromacil (C9H13BrN2O2)	mg/kg	0,009
Bromoxynil (C7H3Br2NO)	mg/kg	0,044
Carbaryl (C12H11NO2)	mg/kg	1,9
Carbofuran (C12H15NO3)	mg/kg	0,68
Chlorothalonil (C8Cl4N2)	mg/kg	0,0084
Chlorpyrifos (C9H11Cl3NO3PS)	mg/kg	49
Cyanazine (C9H13ClN6)	mg/kg	0.12
2,4-Dichlorophenoxyacetic acid (C8H6Cl2O3)	mg/kg	0.43
Dichlorodiphenyltrichloroethane (C14H9Cl5)	mg/kg	12
Diazinon (C12H21N2O3PS)	mg/kg	2,2
Dicamba (C8H6Cl2O3)	mg/kg	0,5
Dichlofop-methyl (C16H14Cl2O4)	mg/kg	2
Dieldrin (C12H8Cl6O)	mg/kg	0,59
Dimethoate (C5H12NO3PS2)	mg/kg	0,0058
Dinoseb (C10H12N2O5)	mg/kg	2,7
Diquat (C12H12Br2N2)	mg/kg	11
Diuron (C9H10Cl2N2O)	mg/kg	1,9
Endosulfan (C9H6Cl6O3S)	mg/kg	0,0013
Endrin (C13H8Cl6O)	mg/kg	2,4
Glyphosate (C3H8NO5P)	mg/kg	0,054
Heptachlor epoxide (C10H5Cl7O)	mg/kg	0,039
Lindane (C6H6Cl6)	mg/kg	0,31
Linuron (C9H10Cl2N2O2)	mg/kg	0,051
Malathion (C10H19O6PS2)	mg/kg	0,82
MCPA	mg/kg	0,42
Methoxychlor (C16H15Cl3O2)	mg/kg	0,046
Metolachlor (C15H22ClNO2)	mg/kg	0,048
Metribuzin (C8H14N4OS)	mg/kg	0,024
Paraquat (as dichloride)	mg/kg	1,1
Parathion (C10H14NO5PS)	mg/kg	7,2
Phorate (C7H17O2PS3)	mg/kg	0,075
Picloram (C6H3Cl3N2O2)	mg/kg	0,024
Simazine (C7H12ClN5)	mg/kg	0,033
Tebuthiuron (C9H16N4OS)	mg/kg	0,6
Terbufos (C9H21O2PS3)	mg/kg	0,08
Toxaphene (C10H8Cl8)	mg/kg	3,3

Parameter	Unit	Value
Triallate (C10H16Cl3NOS)	mg/kg	0,0077
Trifluarin (CC13H16F3N3O4)	mg/kg	0,038
Aniline (C6H5NH2)	mg/kg	0,36
Bis (2-ethyl-hexyl)phthalate (C24H38O4)	mg/kg	34
Dibutyl phthalate (C16H22O4)	mg/kg	0,54
Dichlorobenzidine	mg/kg	4,2
Diethanolamine (C4H11NO2)	mg/kg	2
Diethylene glycol (C4H10O3)	mg/kg	10
Diisopropanolamine (C6H15NO2)	mg/kg	14
Ethylene Glycol (C2H6O2)	mg/kg	60
Hexachlorobutadiene (C4Cl6)	mg/kg	0,036
Methanol CH3OH	mg/kg	37
Methylmethacrylate (C5H8O2)	mg/kg	1,3
Monoethanolamine (C2H7NO)	mg/kg	20
Methyl tert-butyl ether (MTBE)	mg/kg	0,044
Nonylphenol + ethoxylates	mg/kg	14
Phenol) C6H6O)	mg/kg	0,0028
Sulfolane ((CH2)4SO2)	mg/kg	0,18
Triethylene glycol (C6H14O4)	mg/kg	100
Radionuclides		
Uranium -238 Series (all progeny)	Bq/kg	0,3
Uranium - 238 (238U, 234Th, 234mPa, 234U)	Bq/kg	10
Thorium-230	Bq/kg	10
Radium -226(in equilibrium with its progeny)	Bq/kg	0,3
Lead-210 (in equilibrium with 210 Bi and 210 Po)	Bq/kg	0,3
Thorium-232 Series (all progeny)	Bq/kg	0,3
Thorium-232	Bq/kg	10
Radium-228 (in equilibrium with 228AC)	Bq/kg	0,3
Thorium-228 (in equilibrium with its progeny)	Bq/kg	0,3
Potassium-40	Bq/kg	17

4.2.7.5 Executive regulations for the protection of aquatic environments from pollution

The Ministry of Environment, Water and Agriculture announced the start of implementing the executive regulations for the protection of aquatic environments from pollution in all regions of the Kingdom, based on the environment system issued by Royal Decree No. (M/165) dated 11/19/1441 AH.

The ministry explained that the regulation applies to all persons and activities related to aquatic environments and aims to define the scope of the work of the National Center for Controlling Environmental Compliance with regard to protecting aquatic environments from pollution, by proposing standards, controls and requirements, and preparing and implementing plans aimed at reducing pollution of aquatic environments.

Mitigating its effects, proposing programs, studies and research related to aquatic environments, periodic monitoring and evaluation of environmental indicators, determining the procedures and measures to be taken when people approach exceeding standards related to aquatic environments, approving rules and requirements related to licenses or permits for environmental works or activities that have environmental impacts, and issuing Permits and licenses, collecting the financial compensation, organizing various activities for environmental guidance, in addition to inspection and control of violations, imposing penalties, and coordinating with the concerned authorities to enforce the regulation.

The Executive Regulations for the protection of aquatic environments from pollution establish the provisions related to water (coastal waters, Surface water and underground water) and its protection from pollution Including preventive measures to prevent pollution. They include “Ambient water quality standards” in its Annex (1).

4.2.7.6 Standards and specifications for types of water

This standard stems from the water law issued by Royal Decree No. (M/159) dated 11/11/1441 AH, and from its objectives related to this regulation are the following:

- 1- Ensuring the provision of safe, clean, reliable, high quality and competitive water supplies at reasonable competitive prices, achieving justice among consumers, with each person having access to water to meet his needs.
- 2- Enhancing the participation of the private sector in the activities subject to the law and promoting effective governance.
- 3- Every person has access to clean, safe, water that conforms to the approved specifications; to satisfy his natural needs, based on justice; In accordance with approved standards, plans and programs.

The standards establish the provisions related to required effluent quality for restricted and unrestricted use. This includes the following:

- Standards for the quality of unbottled drinking water
- Non-potable water quality standards
- Treated wastewater quality standards
- Commercial wastewater quality standards- to municipal collection systems
- Sludge standards

4.2.7.7 The executive regulation for Air Quality

The Executive Regulations for Air Quality establish the provisions related to air quality and its protection from pollution. They include "Air Quality Standards for Basic Pollutants" in its Annex (1) and "Air Quality Standards for Hazardous Pollutants" in its Annex (2), excluding accidents and natural conditions such as dust storms, forest fires, volcanoes, etc. and cases decided by the Centre related to accidents and internal disasters. Table included in Annex 1 is shown below:

Table 13 : Air Quality Standards for Basic Pollutants contained in Annex 1 of the Executive Regulations for Air Quality of the current Environmental Law

Pollutant	Measurement micrograms/m ³ (µg.m-3) *1	Permissible transgressions	Average time
Carbon Monoxide CO	40,000	Once a year	hour
	10,000	Twice a month	8 hours
Nitrogen dioxide NO ₂	200	24 per year	hour
	100	-	annual
Sulphur dioxide SO ₂	441	24 per year	hour
	217	3 per year	24 hours
	65	-	annual
Ozone O ₃ ²	157	25 days annually, averaged over 3 years	8 hours
suspended particles (<10 µm) PM ₁₀ ³	340	12 per year	24 hours
	50	-	annual
	35	12 per year	24 hours

¹ Values are based on a standard temperature of 25°C and a pressure of 1 atmosphere.

² To calculate the 8-hour ozone value and to assign it to the appropriate day, the following rule is applied: The maximum daily concentration for 8 hours must be determined by checking the running averages for 8 hours, calculated from the hourly data and updated hourly. Each average 8 hours calculated is assigned to the day it expires, meaning that the first calculation period for any day will be the period from 5 pm on the previous day to 1 am of the day. The last calculation period for any day is from 4 after noon to 12 o'clock at night.

^{3,4} Calculation of excesses: The contributions from natural sources can be assessed by measurements, modelling, and remote sensing. These contributions are subtracted from the air quality monitoring results, thus calculating exceedances.

Pollutant	Measurement micrograms/m ³ (µg.m-3) * ¹	Permissible transgressions	Average time
suspended particles (<2.5 µm) PM _{2.5} ⁴	15	-	annual
Lead in suspended particles Pb (in TSP)	0.15	Average over 3 months with no irregularities	3 months

The table above provides the relevant values for each important air quality parameter for the executive air quality regulation 2020. The executive air quality regulation 2020 are straightforward and apply to all circumstances. However, the IFC standards require a certain level of interpretation due to various 'interim' and 'guideline' values being specified rather than fixed limits. The WHO guidelines provide interim targets for countries that still have very high levels of air pollution to encourage the gradual cutting down of emissions.

4.2.7.8 The executive regulation for noise

The provisions of the Noise Executive Regulations shall apply to all persons in residential, commercial, industrial, and environmentally sensitive areas, roadsides, and construction sites; It does not include indoor noise.

Emissions from the different operating areas of the project must comply with the standards of operational noise as described in the environmental standards of noise allowed in proximity of roads.

Table 14 : Noise limits near road area

Evening time (dB)	Daytime (dB)
65	70

The table below shows the exceptions to the application of the permissible noise limits. The National Center for Environmental Compliance also specifies any other exceptions it deems appropriate.

Table 15 : permissible noise limits exceptions

Notes	Exceptions
all the time	Prayer call
all the time	military activities
all the time	Airports, commercial and private aircraft, including helicopters
all the time	Railways

During operational activities	commercial port activities
during festivals	Festivals
Subject to the evaluation of the center	Major disruptions, emergencies or closures
Subject to a permit as specified by the regulations	Excesses allowed by the center

The provisions of the Executive Regulations for Noise shall apply to all persons in residential, commercial, industrial, and environmentally sensitive areas, roadsides, and construction sites, not including indoor noise. Article 4 contains the Measurements of Noise Levels for residential and commercial areas, including the following categories:

- includes low-density residential areas in addition to iconic areas, including tourist attractions and recreational parks, and areas around hospitals, schools and homes for the elderly, nurseries, and environmentally sensitive areas
- Includes residential areas of medium density
- Includes high-density residential areas and areas that include a mixture of residential and commercial activities
- Includes commercial areas, including warehouses and financial centres.

It is not permitted to exceed the noise levels established for residential and commercial areas, except with the permission of the NCEC, which are shown in the next table:

Table 16 : Measurement noise levels for residential and commercial areas

Category	Daytime $L_{Aeq, T}$ (dB)	Night-time $L_{Aeq, T}$ (dB)
A	50	40
B	55	45
C	60	50
D	65	55

Article 7 sets the limits for permitted noise levels at construction sites so that the noise level standards set out in this Regulation are allowed to be exceeded during construction works from 7 am to 6 pm, as indicated in the following table:

Table 17 :Corrective limits for permitted noise levels at construction site

Duration of the construction activities	Correction of permitted noise limits $L_{Aeq, T}$ (dB)
Up to 2.5 hours	10
2.5 to 8 hours	5
Above 8 hours	0

4.3 International standards

4.3.1 International Finance Corporation (IFC) Performance Standards

Given that the project is likely to attract private sector finance, it is assumed that an ESIA would need to assess the environmental impacts in accordance with the International Finance Corporation (IFC) Performance Standards. For projects located in non-OECD countries (as is the case for KSA), the ESIA should refer to the IFC Performance Standards and IFC Environmental Health and Safety Guidelines, which provide general and sector specific guidance.

All IFC projects or projects where IFC Performance Standards (updated 2012) are adhered to must meet with the following Performance Standards on Environmental and Social Sustainability:

- **Performance Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts.
- **Performance Standard 2:** Labour and Working Conditions.
- **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; and
- **Performance Standard 8:** Cultural Heritage.

In addition to meeting the requirements under the Performance Standards, projects must also comply with applicable national laws, including those laws implementing host country obligations under international law.

The IFC has prepared a series of Environmental Health and Safety Guidelines, which provide general and sector specific guidance. These documents provide details of the required levels and considerations when undertaking an ESIA for a project. The following would specifically be referred to as part of the preparation of an ESIA for the project:

- IFC General EHS Guidelines (2007);
- IFC EHS Guidelines for Tourism and Hospitality Development (2007);
- IFC EHS Guidelines for Electric Transmission and Distribution
- IFC EHS Guidelines for Waste Management Facilities
- IFC EHS Guidelines for Water and Sanitation

On applying these Guidelines, the IFC expect that when host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of

the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance level protects human health and the environment.

4.3.2 Equator Principles

In October 2002, the IFC convened a meeting of banks in London to discuss environmental and social issues in project finance. It was decided to try to develop a banking industry framework for addressing environmental and social risks in project financing. This led to the drafting of the Equator Principles. On June 4th, 2003, 10 banks from seven countries signed up to the Equator Principles, a voluntary set of guidelines for assessing and managing environmental and social risks in project financing. To date, in excess of 60 financial institutions operating in more than 100 countries worldwide have adopted the Equator Principles. As a result, the Equator Principles have become the industry standard for addressing environmental and social issues. During March to May 2006, the Equator Principles Financial Institutions (EPFIs) engaged in a substantive review of the Equator Principles. The revised principles became effective from July 6th, 2006, although have recently been superseded by a third revision on 4th June 2013. This revision is referred to as ‘Equator Principles III’ (EP III).

The EPs are updated periodically. The latest iteration, EP4, was released on 18 November 2019. It came into effect for all EPFIs on 1 October 2020. This revision is referred to as ‘Equator Principles 4 (EP 4).

EP 4 ensures a strengthened framework for both social and environmental aspects and will result in benefits for Equator Principles Financial Institutions e.g. improved transparency in reporting, and focus on emerging social and environmental concerns.

The key points to note are as follows:

- The Equator Principles apply to all new project financing that has a total capital cost of \$10 million or more across all industry sectors (the previous threshold was \$50 million);
- For projects with potentially significant social and environmental impacts (Category A and B), the borrower must complete and disclose a Social and Environmental Assessment (EIA) (previously called an Environmental and Social Impact Assessment). The EIA must now comprise a detailed assessment of social and environmental impacts including labor, health and safety; and
- In the context of the project, the EIA report must address the relevant potential impacts and risks.

The Equator Principles is a risk framework for identifying, assessing and managing environmental and social risks in project finance transactions. This framework is based on the IFC Performance Standards and the World Bank Group EHS Guidelines. Equator Principles Financial Institutions (EPFIs) have adopted the Equator Principles in order to ensure that the Projects financed are developed in a manner that is socially responsible and reflects sound

environmental management practices. The principles comprise a set of ten broad principles that are underpinned by the environmental and social policies, standards and guidance of the IFC. The Equator Principles are as follows:

- Principle 1: Review and Categorization.
- Principle 2: Environmental and Social Assessment.
- Principle 3: Applicable Environmental and Social Standards.
- Principle 4: Environmental and Social Management System and 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.

When a Project is proposed for financing, the EPFI is required to categorize the Project based on the magnitude of its potential risks and impacts. This screening is undertaken using the following categorization scheme of the IFC:

- **Category A:** Projects with potential significant adverse environmental social risks and/or impacts that are diverse, irreversible, or unprecedented.
- **Category B:** Projects with potential limited adverse environmental social risks and/or impacts that are few, generally site-specific, largely reversible and readily addressed through mitigation measures; and
- **Category C:** Project with minimal or no adverse environmental and social risks and/or impacts

Wind Power Plant Project is considered to be a **Category A** project

4.3.3 Project commitments with IFC Ps

This ESIA report has been conducted in accordance with the requirements of the NCEC as well as the IFC Performance Standards as far as practicable (See Tables below).

Table 18 : IFC Performance Standards

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
Performance Standard 1	Assessment and Management of Social and	The first comprehensive Saudi Arabian National Environmental legislation was	The following documents demonstrate adherence to this Performance Standard:

IFC Performance Standards	Local regulation requirement	OBSERVATION /RESOLUTION
Environmental Risks and Impacts. Requirements: Environmental and Social Management System (ESMS): a methodological approach to managing environmental and social risk and impacts in a structure way on an ongoing basis. The ESMS will incorporate: (i) policy; (ii) identification of risks and impacts; (iii) management programmes; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review. Objectives: • To identify and evaluate environmental and social risks and impacts of the project. • To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. • To promote improved environmental and social performance of clients through the effective use of management systems.	enacted in 2001 in the form of the General Environmental Regulation. It entered into force on 2002, and its Implementing Rules were published on 2003. The Environment Law, promulgated by Royal Decree No. (M/165) dated 19 Dhu al-Qadah 1441 AH (corresponding to 10 July 2020) entered into force on January 2021, superseding the 2001 Regulation. Under this regulation, any licensing authority must ensure that an ESIA is prepared for any project that may have a negative environmental impact.	• Environmental and Social Impact Assessment (ESIA); • Environmental Monitoring Management Plan (EMMP); • and ESIA Socio- economic Chapter. • Emergency Response Plan (EERP); (in construction phase) • Stakeholder Engagement Plan (SEP) EPC Contractor will establish an ESMS relevant to the Project and support any ongoing management and reporting as required. EPC Contractor will use the ESMS to manage the implementation of the actions necessary to meet the applicable requirements of all Performance Standard.

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
	- To ensure that grievances from Affected Communities and external communications from other stakeholders are responded to and managed appropriately. - To promote and provide means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.		
Performance Standard 2	Labor and Working Conditions Requirements are outlined for: Working Conditions and Management of Worker Relationship; Protecting the Work Force; Occupational Health and Safety; Workers Engaged by Third Parties; Supply Chain. Objectives: - To promote the fair treatment, non-discrimination, and equal opportunity of workers. - To establish, maintain, and improve the worker-management relationship. - To promote compliance with national employment and labour laws.	Royal Decree No. M/51 Labor Law (2005) is the principal legislation defining the Occupational Health and Safety rights of all workers within Saudi Arabia. The law seeks to provide the guiding principles for workers' rights in terms of pay, welfare, working hours and conditions and access to healthcare. The most relevant chapters and articles relating to Health and Safety are detailed below. Part VI – Work conditions and circumstances provides the regulations for pay, working hours, leave and rest periods. Chapter 2 (Articles 98 – 100) set out the guidelines for working hours, which	The ESIA identify and assesses potential impacts that the proposed project could pose on workers' health and conditions as well as proposing measures to manage and monitor them.

IFC Performance Standards	Local regulation requirement	OBSERVATION /RESOLUTION
• To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. • To promote safe and healthy working conditions, and the health of workers. • To avoid the use of forced labour.	seeks to ensure that workers do not work more than 8 hours a day (40 hours per week), either through regular working patterns, or through averaging across a three week period for shift workers. Working hours are reduced for the period of Ramadan. • Chapter 3 (Articles 101 - 108) define the daily and weekly resting periods for all workers, including the provision of time for prayer, minimum rest times, and meals. • Chapter 4 (Articles 109 - 118) provide the relevant guidance for the provision of annual and sick leave, including the regulations for remuneration. • Part VIII - Protection against occupational hazards, major industrial accidents and work injuries, and health and social services, is the principal section related to the protection of the health of workers. • Chapter 1 (Articles 121 – 126) define the general level requirements on employers to protect workers from occupational hazards. • Chapter 2 (Articles 127 – 131) define the employers responsibilities for the prevention of major accidents.	

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
		- Chapter 3 (Articles 132 – 141) define the rights of employees in the event of work injury or workplace induce disease, including remuneration. - Chapter 4 (Articles 142 - 148) define the employers duties to provide health and social facilities for workers, including the provision of first aid facilities, access to medical supplies, and welfare facilities including prayer rooms. In particular article (147) states:	
Performance Standard 3	Resource Efficiency and Pollution Prevention Requirements are outlined for: Resource Efficiency (Greenhouse Gases and Water Consumption); and Pollution Prevention (General, Hazardous Materials Management and Pesticide Use and Management) Objectives: - To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. - To promote more sustainable use of resources, including energy and water. - To reduce project related GHG emissions.	- Law of Preservation of Water Resources - Law of the National Commission for Wildlife Conservation and Development - Environmental Law - Forest and Pasture Law The Regulations aim to achieve the following: - Preserve, protect and develop the environment and prevent its pollution. - Protect public health from activities and acts that harm the environment. - Conserve and develop natural resources and rationalize their use. - Include environmental planning as an integral part of overall development planning in all industrial,	The ESIA documents how potential impacts on human health and the environment were identified and assessed. The ESIA specifically identifies and describes the assessment of the key strategic and technological alternatives that have been considered for the Project, and the integration of best available techniques (BAT) principles within the facility design in order to minimize significant impacts.

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
		agricultural, architectural and other fields; and • Raise awareness in environmental issues and strengthen individual and collective feelings of responsibility for preserving and improving the environment and encouraging national voluntary efforts in this field.	
Performance Standard 4	Community Health, Safety and Security Objectives: • To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non- routine circumstances. • To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.	health law of 1423 AH Article Three: The kingdom works to provide health care and is concerned with the public health of the community in a way that ensures living in a healthy environment, and this includes the following: 1 - The safety and suitability of drinking water. 2 - Safety and purification of sewage. 3- Safety of food handled. 4- Safety of medicines, drugs and medical supplies in circulation, and monitoring of their use. 5- Protecting society from the effects of the dangers of drugs and intoxicants. 6- Protecting the country from epidemics. 7- Protecting the environment from the dangers of all kinds of pollution. 8- Setting health requirements for the use of public places.	The ESIA identify and assesses potential impacts that the proposed Project could pose on workers and community's health as well as proposing measures to manage and monitor them.

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
		9 - Spreading health awareness among the population.	
Performance Standard 5	Land Acquisition and Involuntary Resettlement. ♦ To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs. ♦ To avoid forced eviction. ♦ To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost⁴ and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. ♦ To improve, or restore, the livelihoods and standards of living of displaced persons. ♦ To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure⁵ at resettlement sites.	Law of Eminent Domain and Temporary Taking of Property Article 2 : The agency owning the project shall prior to initiating the expropriation proceeding verify that the site designated for the project has no state-owned real property sufficient for constructing the project.	The MoE has been allocated the Government land for the Project. The ESIA identifies and addresses potential impacts resulting from changes to access to the land upon which the Project is to be built. Due to the nature of the Project site location and land ownership, no assessment of resettlement is required as part of the ESIA.
Performance Standard 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources.	The National Biodiversity Strategy for the Kingdom of Saudi Arabia	The ESIA documents how potential impacts biodiversity and living natural resources were identified and assessed.

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
	Objectives: - To protect and conserve biodiversity. - To maintain the benefits from ecosystem services. - To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.	A sectoral document aiming at introducing the conservation and sustainable use of biodiversity into the national planning process; providing the basic information and a significant contribution to the Convention on Biological Diversity ratified by Saudi Arabia. Because the Strategy covers many issues, its effective implementation requires a high level of political support as well as coordination between government, non-governmental organization, and the private sectors.	the ESIA specifically identifies the existing ecological status of the site and describes the assessment of potential impacts to the biodiversity, habitats, and ecosystem services as a result of the Project as well as proposing mitigation measures to manage and monitor them.
Performance Standard 7	- Indigenous Peoples. - Objectives: - To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. - To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. - To promote sustainable development benefits and opportunities for	Statute of Human Rights Commission Under this regulation, a body called (the Human Rights Commission) is established directly linked to the Prime Minister and aims to protect and promote human rights in accordance with international human rights standards in all fields, raise awareness of them, and contribute to ensuring the implementation of this in light of the provisions of Islamic Sharia. It is the governmental body competent to express opinion and advice on human rights issues.	the ESIA describes the assessment of potential impacts that the proposed Project could pose to indigenous peoples that may inhabit the region. The baseline assessment identifies no indigenous peoples occupying the land, but notes expatriate herders are found tending livestock.

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
	Indigenous Peoples in a culturally appropriate manner. - To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life cycle. - To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. - To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.		
Performance Standard 8	Cultural Heritage. Objectives: - To protect cultural heritage from the adverse impacts of project activities and support its preservation. - To promote the equitable sharing of benefits from the use of cultural heritage.	Law of Antiquities All immovable and movable antiquities located in the Kingdom, or in the marine areas under its sovereignty or legal jurisdiction, are considered public property of the state, with the exception of the following: 1 - Fixed antiquities whose owners prove their ownership before the competent authorities. 2- Movable antiquities registered by their owners with the Authority.	the ESIA describes the assessment of potential impacts that the proposed Project could pose to cultural or archaeological heritage as a result of the Project.

IFC Performance Standards		Local regulation requirement	OBSERVATION /RESOLUTION
		3- Movable antiquities that the Authority does not deem necessary to register. Anyone who owns a movable antiquity shall submit it to the Authority for registration within two years from the date this system comes into force.	

4.3.4 Project commitments with equator principle

Equator Principles		Observation	Responsibility
Principle 1	Review and Categorization Categorization of the project based on the magnitude of its potential risks and impacts in accordance with the environmental and social screening criteria of the International Finance Corporation (IFC). The categories are: Category A – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented; Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures²; and Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.	Classification of the project under the environmental law is confirmed by the NCEC, although following the ESIA classification forms, the Project is considered to be a Third Category. It is anticipated that the Equator Principle Financial Institutions (EPFIs) will categorize the project as a Category A project.	MoE obtain the classification of the project under the environmental law and confirmed by NCEC.

Equator Principles		Observation	Responsibility
Principle 2	Environmental and Social Assessment Assessment process to address to the EPFP's satisfaction, the relevant environmental and social risks and impacts of the proposed Project. The Assessment Documentation should also propose measures to minimise, mitigate and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project. For Category A projects the Assessment Documentation includes an Environmental Impact Assessment (ESIA).	The ESIA Scoping Report identified the relevant environmental and social risks and impacts of the proposed Project. Informed by the ESIA Scoping Report, the ESIA was completed to assess all aspects of the project including utilities and infrastructure.	MoE assigns a subcontractor to prepare an ESIA report.
Principle 3	Applicable Environmental and Social Standards Compliance with host country legislation / permits is required to be addressed in the first instance, For Projects located in Non-Designated Countries, the assessment is required to evaluate compliance with the respective IFC Performance Standards and World Bank Group EHS Guidelines. For Projects located in Designated Countries, the relevant host country laws, regulations and permits apply.	Saudi Arabia is a Non-Designated Country; therefore, the assessment process outlined in this ESIA evaluates compliance with the IFC Performance Standards and EHS Guidelines. Where NCEC Regulations are more stringent however, these have been applied.	ESIA will be submitted to NCEC in order to obtain the required permit and to be in compliance with KSA regulation.
Principle 4	Environmental and Social Management System and Action Plan An ESMS to be developed and maintained by the Client for all Category A and B	EPC contractor will establish and maintain an ESMS. this ESIA report includes an Environmental Management & Monitoring Plan (EMMP)	An ESMS will be prepared and continue to be developed by EPC contractor for the life of the Project.

Equator Principles		Observation	Responsibility
	Projects. An Environmental and Social Management Plan is also required to address issues raised in the Assessment and incorporate actions required to comply with the applicable standards.	developed to address and manage the environmental aspects and impacts related to the construction, commissioning, and operation of the Project. The EMMP is considered appropriate as an ESMP. It is anticipated that all applicable standards will have been met to the satisfaction of the EPFI. However, if it is deemed necessary by the EPFI to prepare an Action Plan (AP) to address any gaps identified, EPC Contractor will work with the EPFI to resolve this.	
Principle 5	Stakeholder and Engagement For all Category A and Category B Projects, effective stakeholder engagement must be demonstrated as an on-going process in a structured and culturally appropriate manner with affected communities and where appropriate other stakeholders. For projects with environmental or social risks and adverse impacts, disclosure should occur early in the Assessment process, in any event before the Project construction commences, and on an ongoing basis.	The Stakeholder Engagement Plan (SEP) outlines the approach to be taken in supporting the communications and engagement objectives, processes and deliverables required to support successful delivery of the project. It also identifies the range of people and organizations that may be regarded as stakeholders in the Project and describes the strategy to be used for engaging with these stakeholders in a culturally appropriate manner. The SEP will be prepared and continue to be developed by EPC contractor for the life of the Project.	The SEP will be prepared and continue to be developed by EPC Contractor for the life of the Project.
Principle 6	Grievance Mechanism For all Category A and, as appropriate, Category B	The Stakeholder Engagement Plan (SEP) provides an Action Plan which initiates a	The Grievance Mechanism will be prepared and continue to be

Equator Principles	Observation	Responsibility
Projects, the client will, as part of the ESMS, establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.	grievance mechanism for use during the life of the Project. This will be developed further and maintained by EPC Contractor during all phases of the Project.	developed by EPC Contractor for the life of the Project.
Independent Review For all Category A and, as appropriate, Category B Projects, an independent Environmental and Social Consultant not directly associated with the client will carry out an Independent Review of the Assessment Documentation including the ESMP, ESMS and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence, and assess Equator Principles compliance.	An Independent Technical (ENVIRONMENT) Advisor will be appointed to the project. The EPFI to advise if further Independent Reviewers are appropriate for the (Category A) Project.	EPC contractor will assign the expert as an Independent Reviewer.
Principle 8 Covenants The client will covenant in the financing documentation: to comply with all relevant host country environmental and social laws; regulations and permits to comply with the ESMP and AP (where applicable), to provide periodic reports to the EPFI demonstrating compliance, and to decommission facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.	The ESIA will provide the initial documentation to demonstrate compliance with the appropriate regulations as well as commitments related to the outline plans developed for environmental management and decommissioning/closure.	EPC Contractor will establish and maintain an ESMS relevant to the Project and support any on-going management and reporting as required by the EPFI.

Equator Principles		Observation	Responsibility
Principle 9	Independent Monitoring and Reporting To assess Project compliance with the Equator Principles and ensure ongoing monitoring and reporting after Financial Close and over the life of the loan, the EPFIs will for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the EPFIs.	The EPFI to determine the appropriate requirements for independent monitoring and reporting for the (Category A) Project.	EPC Contractor will assign the expert to verify its monitoring information which would be shared with the EPFIs.
Principle 10	Reporting and Transparency For all Category A and, as appropriate, Category B Projects. • The client will ensure that, at a minimum, as summary of the ESIA is accessible and available online • The client will publicly report GHG emission levels during the operational phase for Projects emitting over 100,000 tons of CO2 equivalent annually. • The EPFI will encourage the client to share commercially non-sensitive Project-specific biodiversity data with the Global Biodiversity Information Facility¹³ (GBIF) and	EPC Contractor may disclose the Assessment Documentation (e.g. Executive Summary of the ESIA) online for this Category A Project. The Project is not expected to emit more than 100,000 tonnes of CO2 equivalent annually; therefore, annually reporting of such emissions will not be required.	EPC Contractor responsibility

Equator Principles		Observation	Responsibility
	relevant national and global data repositories, using formats and conditions to enable such data to be accessed and re-used in future decisions and research applications.		

5. ENVIRONMENTAL AND SOCIAL BASELINE

This section presents environment, ecological and socio-economic baseline of the study area for the proposed 2000 MW Wind Power project in Starah in Riyadh Province.

5.1 Context

Baseline refers to the physical, biological, cultural and human conditions that will prevail in the absence of the project, including interactions amongst them. Establishing baseline helps in understanding the prevailing environmental, ecological and socio-economic status of the study area. It provides requisite information of the biophysical and social environment for decision makers to take appropriate measures regarding the project.

Establishing baseline provides the background environmental and social conditions for prediction of the future environmental characteristics of the area before setting up of the project. It also helps in environmental and social management planning and provides a basis to finalize a strategy for minimizing any potential impact due on surrounding environment due to setting up of the project.

This section establishes the baseline environmental, ecological and socio-economic status of the proposed Wind Power site and surrounding area to provide a context within which the impacts of the proposed Wind Power project are to be assessed.

5.2 Baseline study methodology

An AH environment consultant office, comprising of environment, biodiversity, hydrology, and social experts undertook multiple site visits to understand the site setting, environmental and social sensitivities, baseline data collection and to identify the relevant local stakeholders. The activities undertaken during the site visits has been summarized below:

- Identification of key social and environmental risks/receptors in the study area.
- Understanding of prevailing community engagement processes.
- Understanding aspects of community health and safety, if any, linked to the proposed Project.
- Understanding land-based impacts, livelihood impacts, cultural heritage issues.
- Understanding significance of impacts on biodiversity and natural resource management; and
- Consultations with the local communities and focused group discussions in the vicinity to understand their views and concerns of the Project.

Environmental baseline data was collected through primary monitoring and surveys of the study area. Secondary information through literature surveys was also collected for the study area of the Project.

The primary baseline study undertaken by an accredited laboratory included the following.

- Ambient air quality monitoring at 5 locations within the study area.
- Ambient noise quality monitoring at 4 locations within the study area.
- Soil quality covering different land uses at 35 locations: and

The details of environmental and social baseline conditions in the study area are provided below in this section.

5.3 Environment Baseline

Environmental baseline data was collected through available literature and studies related to the project area and site surveys. baseline data collection involved identifying and collecting available published material and documents containing information on various environmental aspects like soil, geology, hydrology, drainage, ecology etc.

A brief description of the existing physical environment within the project site is detailed in the sections below.

5.3.1 Land Use and Land Cover

Land use/ cover inventories are an essential component in land resource evaluation and environmental studies due to the changing nature of land use patterns in the AoI. Based on site visits and observations from maps and satellite images it is understood that there is no current land use of the project site.

5.3.2 Climate and Meteorology

5.3.2.1 Overview

The project site is located near the center of the Arabian Peninsula, 500 km from the Red Sea, 400 km from the Arabian Gulf, and 1200 km from the Gulf of Aden. Temperatures Low at night, low levels of precipitation. The hottest period is April to October, the coldest period is from November to March. Total annual precipitation is around 110 mm, most of which falls on a few days or even occurs on one day each year between October and May.

July is the hottest month with an average temperature of 36°C. The coldest month is January with an estimated temperature of 15°C. The average annual temperature in Riyadh is 25.4 degrees Celsius. April is the wettest month with an average precipitation of 25 mm, and June to September is the driest, with little to no rain. The maximum hours of sunshine on any given day is 11 hours in July. The heat becomes intense soon after sunrise and lasts until sunset. Winter

temperatures rarely drop below 0°C, but the almost complete absence of moisture and the wind chill factor makes the air look very cold.

in rated Koeppen-Geiger, the Kingdom's climate is BWh: dry desert with an average temperature above 18°C.



Figure 16 : Long-term average temperature and precipitation

The figure shows long-term average temperatures and precipitation. The average atmospheric pressure is 705 mm Hg. Class A evaporation ranges from 89 mm in December to 378 mm in July, with an average of 231 mm/month and a total of 2758 mm/year, which far exceeds precipitation.

The following figure shows the locations of the weather stations in Riyadh, which are the following:

- R001 Station R001-Al Masani (Est. 452)
- R007-Dirab (Est. 458)
- King Khalid International Airport (KKIA) (Est. 40437)
- Old Airport (Est. 40438)

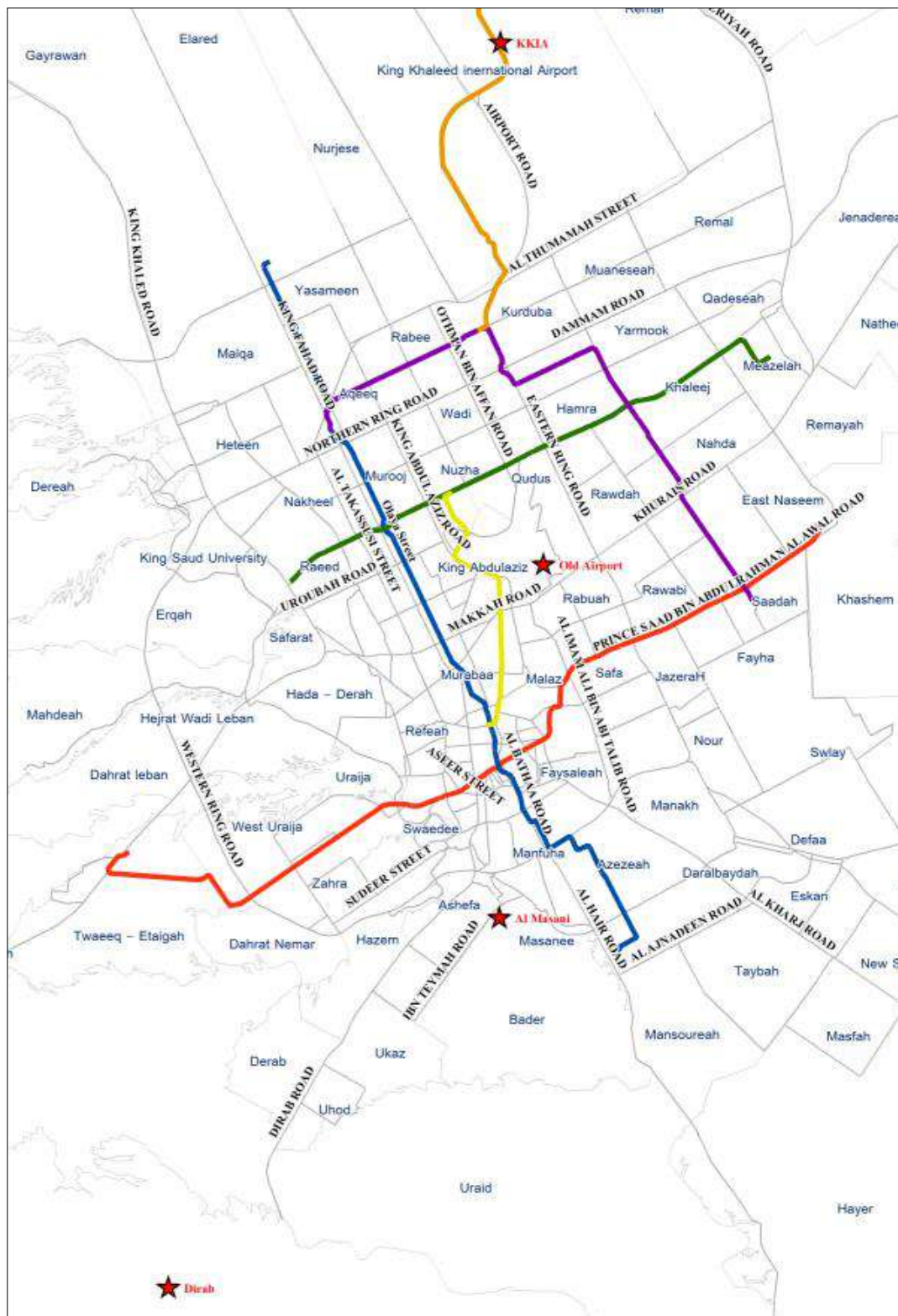


Figure 17: Weather stations in Riyadh

5.3.2.2 Temperatures

The average annual temperature in Riyadh is 24.9°C at the R001 station (Al-Masani). The temperatures given are in shaded areas and do not indicate temperatures in direct sunlight.

January is the coldest month and July is the hottest. Records show that the average maximum temperature for July is 43.6°C at R001 (factories) and 43.5 at 40438 (old airport). Meanwhile, records show that the average minimum temperature for January is 6.7°C at R001 (factories) and 8.9°C at 40438 (old airport). Records show that the absolute maximum temperature is 49°C for July at station R001 (factories) and absolute minimum temperature is -2.2°C for January at station 40438 (old airport).

5.3.2.3 Rainfall

Rain is one of the most important climatic elements with direct and indirect effects on human life. Rain in the Riyadh region is fluctuating between very small quantities and large and little and sometimes falls in large quantities in small time, causing flooding that fill the western dams of the region, such as the Wadi Hanifa Dam and Wadi Laban Dam. Precipitation falls in most of the region in winter, spring, and fall, with average rainfall ranging between 80 and 100 mm (about four inches).

The distribution of rain is rare and intermittent. The average annual precipitation is between 84.3 mm for the R001-Al-Masani station and the old airport terminal is 90.5 mm.

The rainy season is between December and May. March, April, December and January are the wettest months. Total annual precipitation over Riyadh is much less than evaporation for the year and in any month.

Despite the lack of rain and irregular rainfall in the Riyadh region, due to its location in the dry tropical region, it still constitutes a critical importance for wildlife as many desert plants scattered in the region depend on it, which is an important factor in the environment to achieve balance, as well as Feeding the aquifer water that is under great pressure, as a result of increased water consumption.

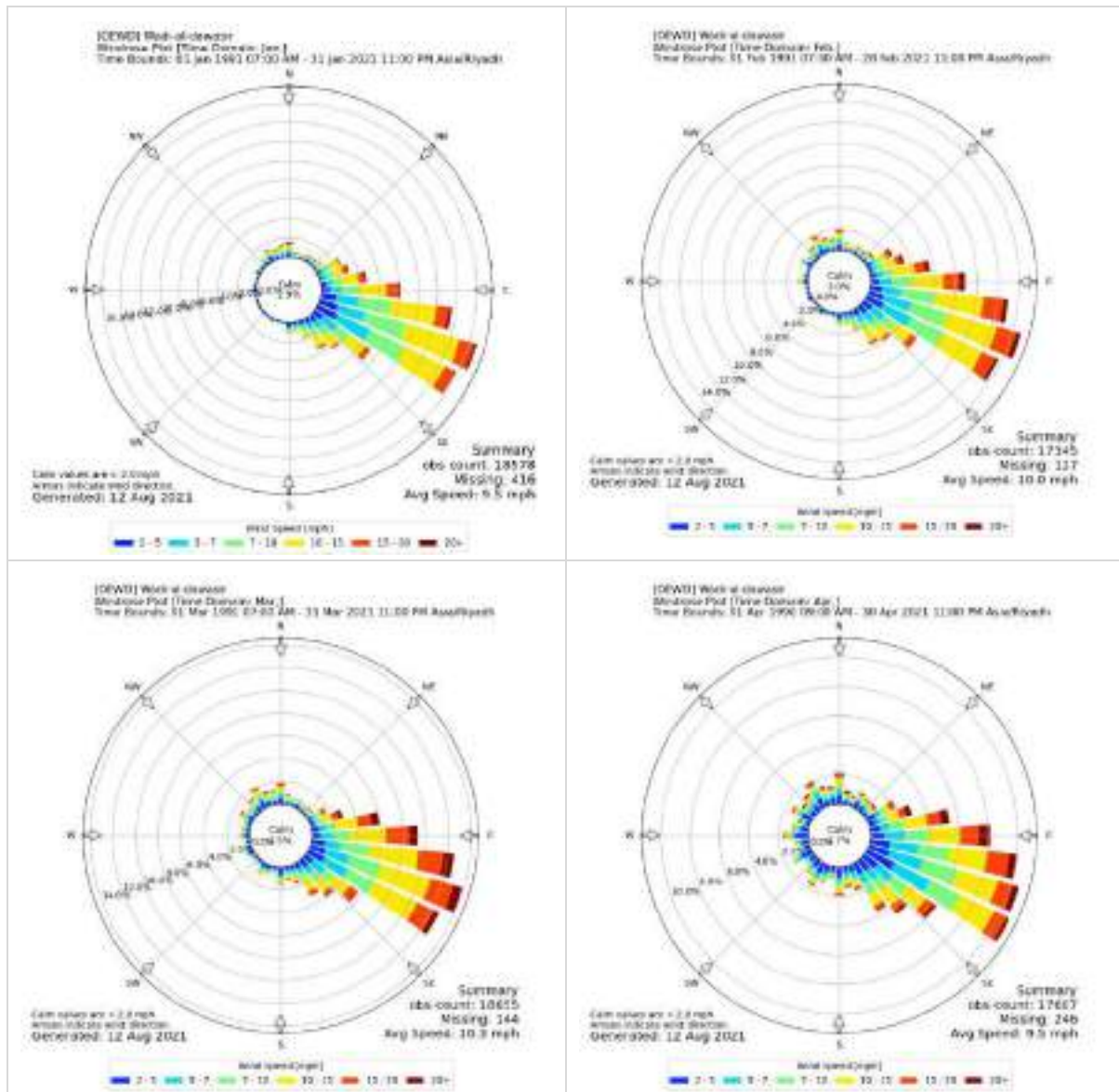
5.3.2.4 Relative humidity

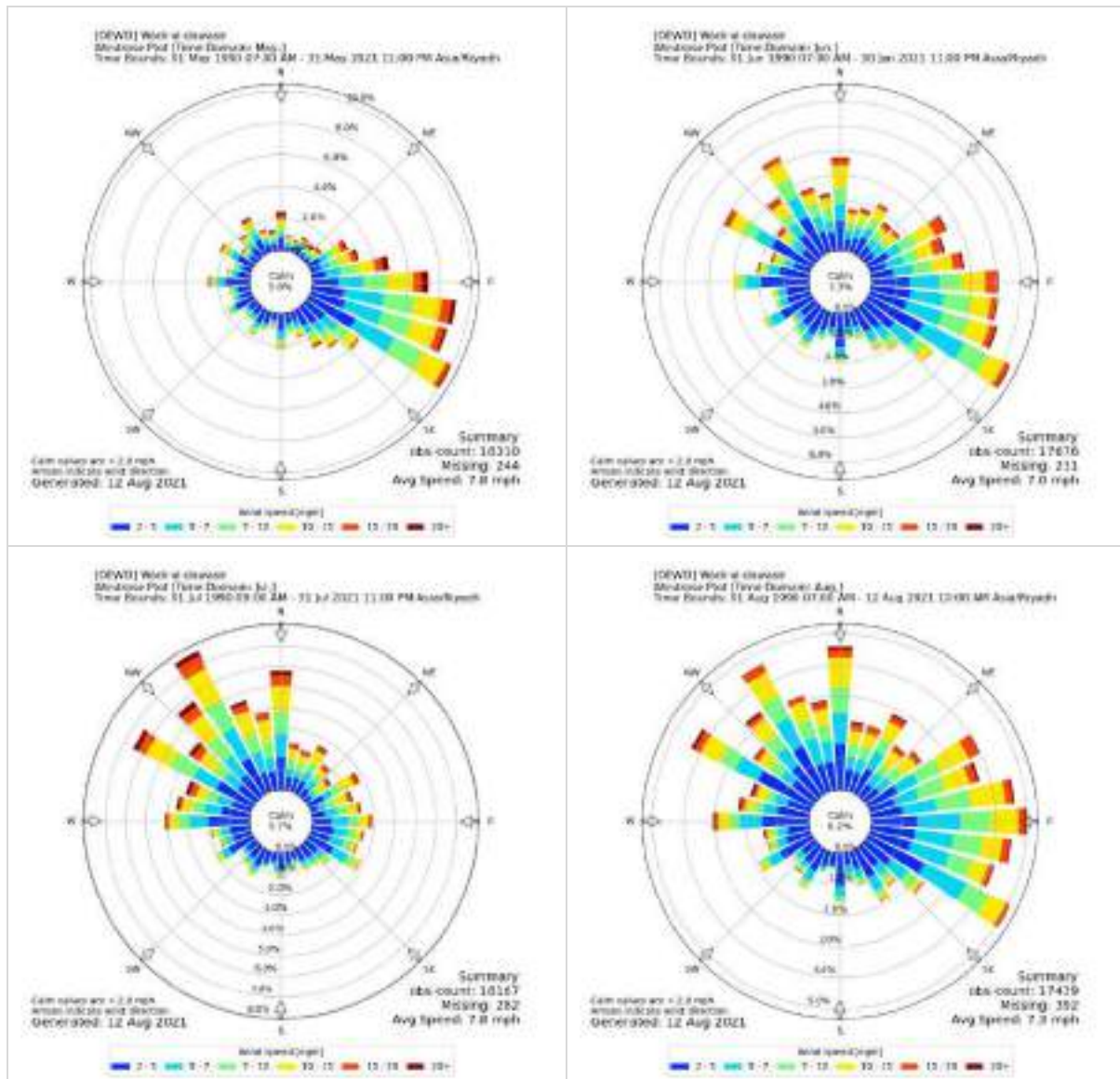
Humidity is the amount of water vapor suspended in the air resulting from evaporation. Absolute humidity reaches its end in the tropics and then decreases towards the poles. Air humidity is closely related to temperature and atmospheric pressure. The higher the humidity, the lower the evaporation rates. The relative humidity in general is high in the coastal areas and very low in the inland areas because the Red Sea and the Arabian Gulf are the source of moisture in the first place. While the inland parts which are far from the seas, enclosed and do not contain lakes or

rivers, relative humidity is low. Humidity rises in winter due to the relatively low temperature. In the Kingdom, humidity is relatively low and the average annual relative humidity is more than 60% in the coastal areas on the Arabian Gulf and the Red Sea, while it ranges from 30% to 55% in the southwestern region. Low humidity is observed in the study area throughout the year, especially in the summer period, and the highest humidity is in winter, where humidity levels in this region reach (19%) in summer, and slightly exceed (45%) in winter, and the lowest value of humidity In June and July the highest value is in December and January.

5.3.2.5 Wind

The winds during May and June are usually very dusty and cause sandstorms. The annual prevailing wind direction is from the southeast (38%) and northwest (20%). Meteorological records of wind speeds range from 3.5 km/h (minimum recordable speed) to 6 km/h with an annual average of about 5 km/h. Average monthly top speeds vary from 14.5 km/h to 22 km/h. These winds are usually moderate to severe for most of the year. Also, south winds blow during winter, spring and fall accompanied by high temperature. Winds may be active at times and will increase in speed, causing dust and sandstorms, accompanied by thunderstorms and rain.





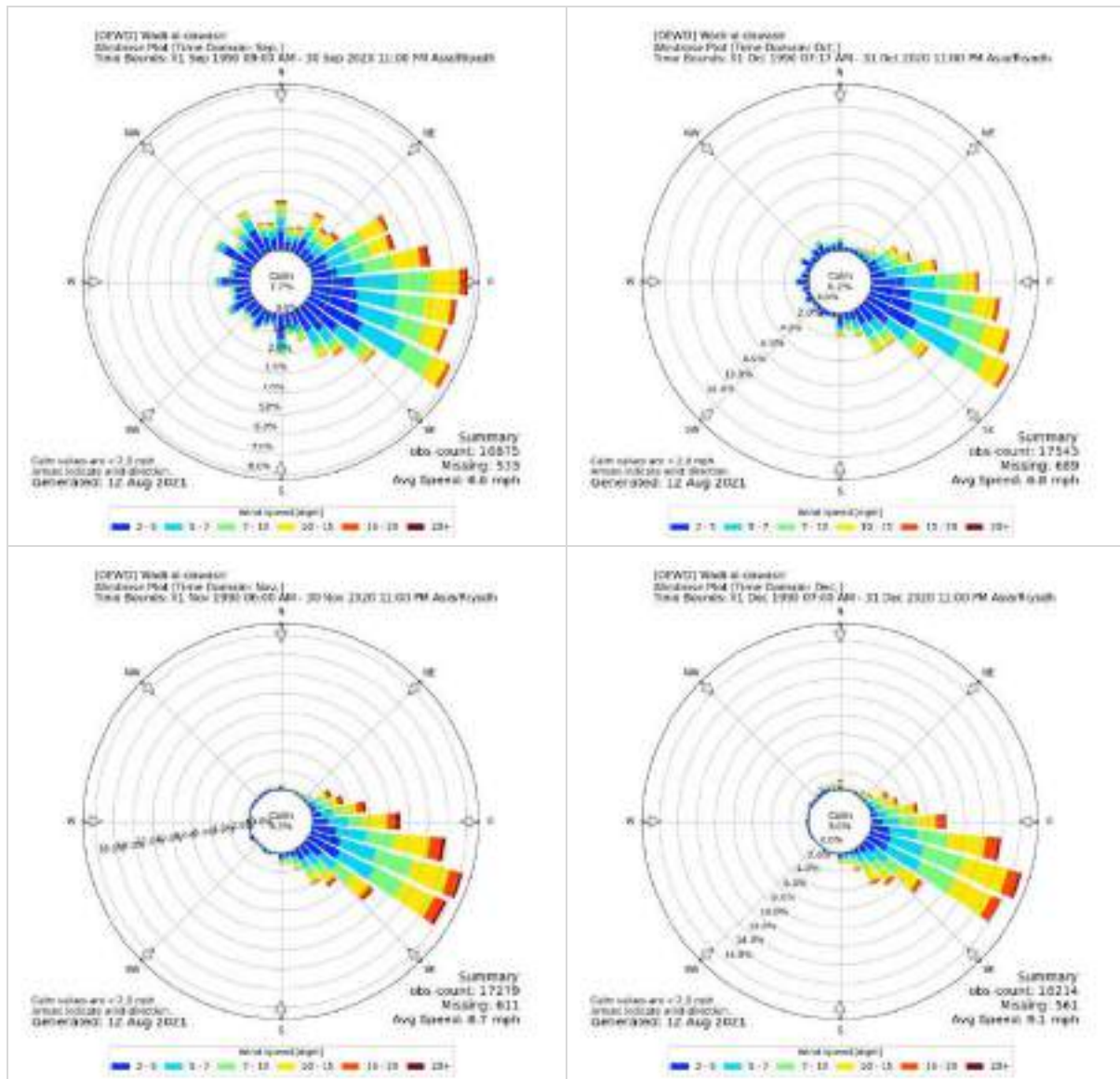


Figure 18 : Wind Roses by Month for Wadi Ad-Dawasir

5.3.3 Air Quality

The main purpose of the baseline characterization process is to identify existing air quality conditions, key sources of emissions, and environmental & social sensitive receptors that may potentially be affected by the project’s construction or operation, concerning air quality. The environmental baseline is then used as the basis for the assessment of any future impacts over the identified sensitive receptors.

Riyadh is located in the middle of the deserts of the Arabian Peninsula, the city has always suffered from wind dust. With their seven million people living in it, Riyadh is among the biggest

city in the World. As, all the big cities in world, Riyadh suffers from the exhaust emissions of nearly 20 million vehicles.

The following figure shows the latest air quality update in Riyadh. The following air quality indicators were taken (AQI) for each pollutant from the Shumaisi station and Al-Uraija station on 15/11/2021. The air quality data sources for this chapter are the National Center of Meteorology, Kingdom of Saudi Arabia.



Figure 19 : Air quality index of in Al-Shumaisi and Al-Uraija station

5.3.4 Topography and landscape

The contour lines defining the orography of the project have been obtained from basic digital cartography. From the creation of a DTM (Digital Terrain Model), curves have been generated, interspersed every 1 m. These are available to evaluate the orographic complexity of the site, although in the attached maps they are shown with an interval of 10 m to facilitate their visual interpretation.

As can be seen, there are large differences in elevation of up to 400 m, with elevations in the order of 1,100 m in the highest parts and close to 700 m in the lowest parts. This is due to the presence of a valley that crosses the project area from north to south, generating these large differences in height.

There is also the presence of many ravines that run from the higher areas towards the depressed area of the valley. The contour lines map obtained is shown below.

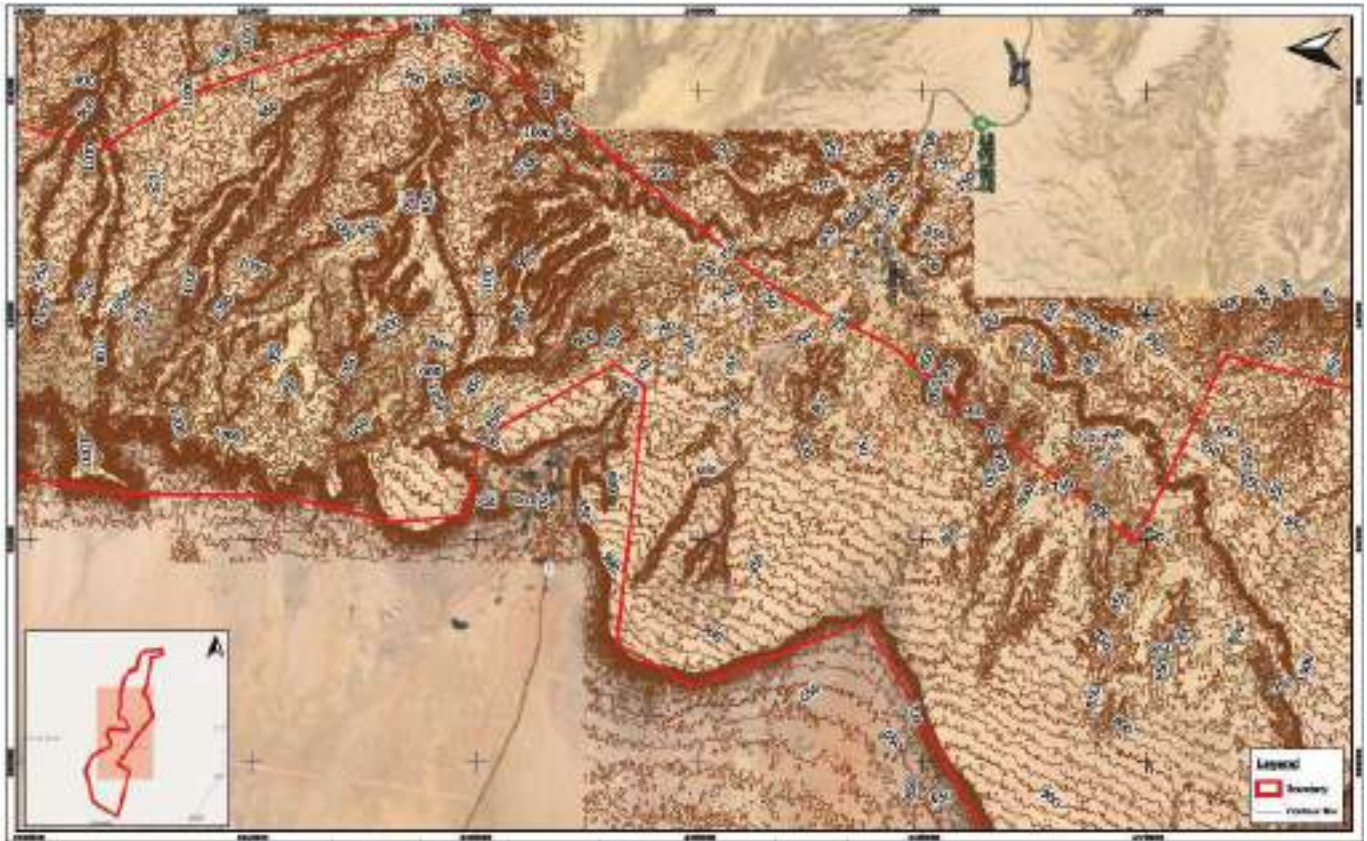


Figure 20: Digital terrain model for the project site – part 1



Figure 21 : Digital terrain model for the project site- part 2

5.3.5 Geology

5.3.5.1 Geology of Riyadh region

5.3.5.1.1 Geological map of Riyadh

The geological map of the Riyadh region shows the presence of two main split geographical zones in shape of arc, between sedimentary rocks and different deposits versus igneous and metamorphic rocks.

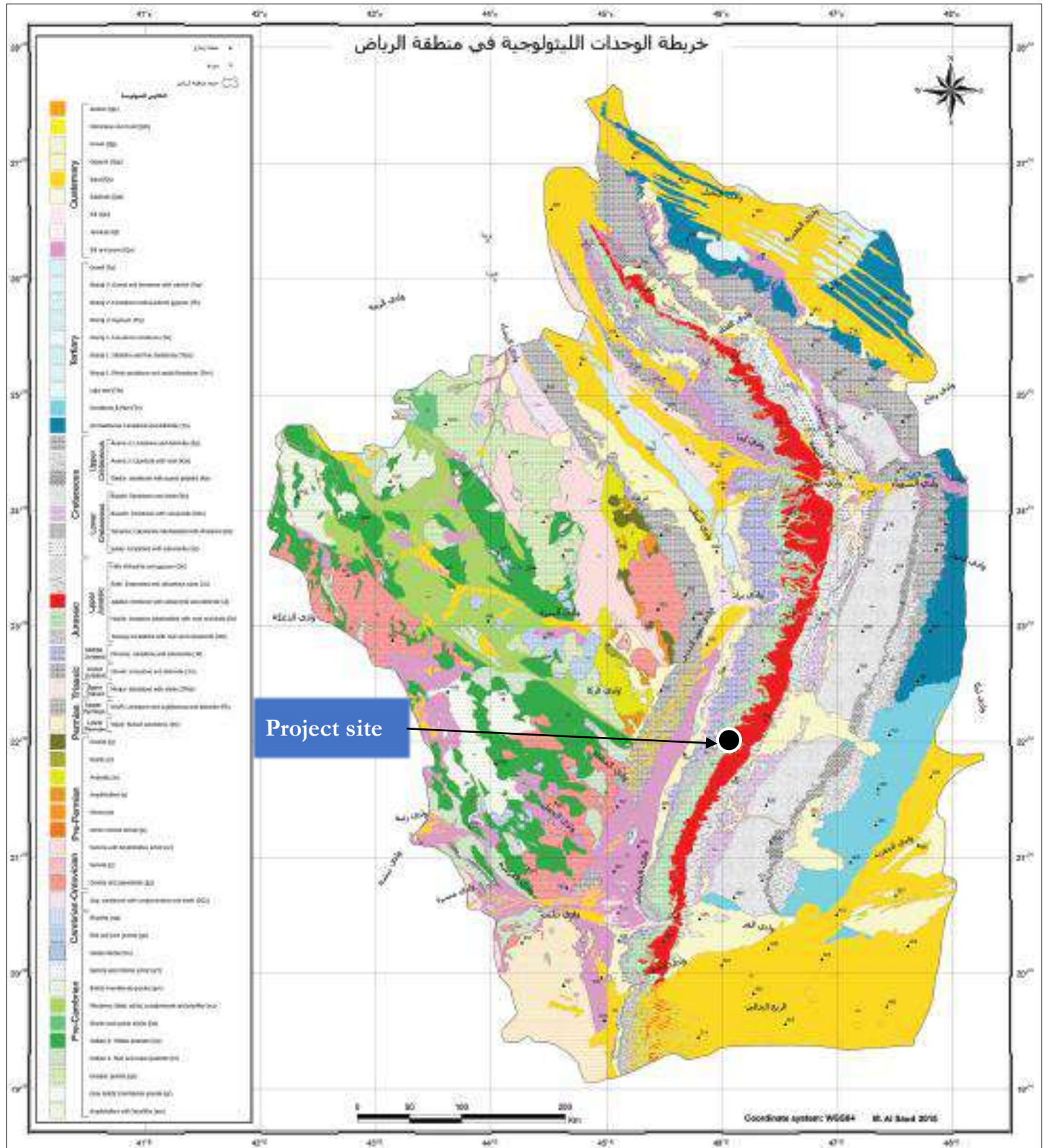


Figure 22: Geological map of Riyadh Region

The first (sedimentary) zone is the largest and is located on the eastern side of the region, while the second zone is located on the western side. The second zone is considered part of the Arab shield of the Arabian Peninsula, specifically the eastern part of the shield as well.

It is noticeable that the various lithological units in the eastern region were affected by the push force resulting from the movement of the Arabian Shield, as it clearly shows the bending of geological formations in the region, specifically from the rocks of the Triassic period and above of the younger formations. As for Rub' al Khali, it remains the distinct geographical spot on the map in terms of the presence of a single lithological component and the absence of any evidence for longitudinal divisions.

As for the longitudinal divisions, according to the map, the faults play an important role in the geographical distribution in several lithological domains, where it is clear that the boundaries of some geographic distributions of lithological units coincide with the extension of some faults. In addition, there are many faults whose extension ends with the presence of igneous and metamorphic rock masses belonging to the Arabian Shield in particular, as is evident in the areas of Wadi Al-Raka, Wadi Al-Qamar, Wadi Al-Hammal and Wadi Al-Farsha.

5.3.5.1.2 Geological scale of Riyadh

The geological scale of the Kingdom of Saudi Arabia consists of 107 lithological units that include sedimentary, igneous and metamorphic rocks, in addition to many fillings of volcanic magma. As some of them are defined within major geological formations (Rock Formations) and are specified by spatial names (such as formations: Al-Jubaila, Muharram, Tuwaiq, Manjur, etc.), which are numbered 29 major geological formations, and are distributed from the Precambrian to the Quaternary with a total thickness over 6400 meters (1963, Powers et al).

As for the Riyadh region, there are 65 lithological units according to the available maps, including 23 major geological formations. After sorting the repeated formations within the Quaternary geological era, the number of these units became 58 lithological units (Table 16). Also, some geological formations are divided into units (such as the Al-Kharj-1 and Al-Kharj-2 formation) due to the difference in the lithological component within each unit.

Table 19: lithological units in Riyadh Region

period Geologic	Formation Name	unit Lithological	Code	(km2) area	thickness (m)
Quaternary		Aeolian	(Qa)	9.17	>10
		Calcareous duricrust	(Qdc)	13.14	3
		Gravel	(Qg)	32052.92	variable
		Gypsum	(Qgy)	68.48	variable
		Sand	(Qs)	65880.21	variable
		Sabkhah	(Qsb)	120.41	variable
		Silt	(Qsi)	2280.15	variable
		Terraces	(Qt)	26.84	variable
Lower Cretaceous	Tertiary	Silt and gravel	(Qu)	24050.22	variable
		Gravel	(Tg)	267.14	variable
		Kharaj-2 Gravel and limestone	(Tcg)	1384.05	not specified
		Kharaj-2 Limestone and gypsum	(Tk)	126.99	not specified
		Kharaj-2 Gypsum	(Tkj)	3444.24	not specified
		Kharaj-1 Lacustrine limestone	(Tkl)	4.82	not specified
		Kharaj-1 Siltstone and sandstone	(Tkps)	523.99	200
		Kharaj-1 Marly sandstone and limestone	(Tsm)	3293.13	30
		Lake bed	(Tlb)	12.74	803
			(Tn)	11353.84	320
			(Tn)	11353.84	variable
		Um Radhuma Limestone and dolomite	(Tu)	14568.65	87
		Aruma-2 Limestone and dolomite	(Ka)	14400.39	120
		Aruma-2 Quartzite with marl	(Kas)	4740.45	not specified
		Wasi'a Sandstone with quartz pebbles	(Kw)	3673.47	52
Upper Jurassic	Jurassic	Biyadh Sandstone and shale	(Kb)	18588.46	401
		Buwaib Limestone with calcarenite	(Kbu)	3221.17	46
		Yamama Calcarenite with limestone	(Ky)	941.58	57
		Sulayy Limestone with calcarenite	(Ks)	3357.66	155
		Hith Anhydrite and gypsum	(Jhi)	166.74	90
		Arab Evaporates and calcareous rocks	(Ja)	5050.17	32
		Jubaila Limestone with calcarenite	(Ji)	11859.46	87
		Hanifa Limestone with marl and shale	(Jh)	8928.7	125

period Geologic		Formation Name	unit Lithological	Code	(km2) area	thickness (m)
		Tuwayq	Limestone with marl	(Jtm)	7525.73	192
Middle Jurassic		Dhurma	Limestone and calcarenite	(Jd)	665.98	375
Lower Jurassic		Marrat	Limestone and dolomite	(Jm)	1877.28	126
Upper Triassic	Triassic	Minjur	Sandstone with shale	(JTRm)	3983.84	227
Upper Permian		Khuff	Limestone and dolomite	(Pk)	9533.35	190
Lower Permian		Wajid	Nubian sandstone	(Pw)	8608.15	~600
	Pre-Permian		Granite	(g)	1002.69	very deep
			Diorite	(d)	242.19	very deep
			Andesite	(m)	3246.27	very deep
			Amphibolites	(a)	727.76	very deep
			Schist	(as)	254.88	not specified
			Green chlorite schist	(gs)	15.13	~600
			Sericite with Amphibolites schist	(sc)	9921.57	~800
			Sericite	(s)	145.17	not specified
			Granite and grandiorite	(gg)	14365.67	very deep
Saq	Cambrian - Ordovician	Sandstone with conglomerates	Sandstone with conglomerates	(Ocs)	1880.23	60
		Rhyolite	Rhyolite	(rtp)	9.74	very deep
		Red and pink granite	Red and pink granite	(gp)	3101.77	very deep
		Farida	Marble	(fm)	357.64	~110
			Sericite and chlorite schist	(scf)	161.58	not specified
			Biotitic-hornblende granite	(gm)	5331.3	very deep
		Murdama	Slate, schist, conglomerate	(mu)	13432.34	not specified
	Pre-Cambrian		Diorite and quartz diorite	(hd)	832.9	very deep
		Halban-2	Felsitic andesite	(ha)	23551.69	very deep
		Halban-1	Marl and wake quartzite	(hc)	6410.97	not specified
			Gneissic granite	(gn)	12462.58	very deep
			Gray biotitic-hornblende granite	(gr)	5125.94	very deep
			Amphibolites with Xenoliths	(am)	59.37	very deep

It appears that the geological scale of the Riyadh region is from the Precambrian era to the modern Quaternary era of different sediments, noting the absence of some formations related to other geological eras (for example: Silurian and Middle Cretaceous). The thickness of some

units is not specified either because of the difficulty of measurement, or its thickness is variable such as some formations of the Quaternary era, or it is related to the units of rocks emerging from great depths such as volcanic magma.

5.3.5.1.3 Geology of Starah

In this section a preliminary analysis of the geological formations present in the area is made, in later phases a geotechnical survey of the selected area will be carried out to analyze it in further detail.

According to MAP I-212A (Miscellaneous Geologic Investigations, 1956) elaborated by the Directorate General of Petroleum and Mineral Affairs (Kingdom of Saudi Arabia) and the United States Geological Survey (at a scale of 1:500,000), the geological materials that have been identified in this study area are.

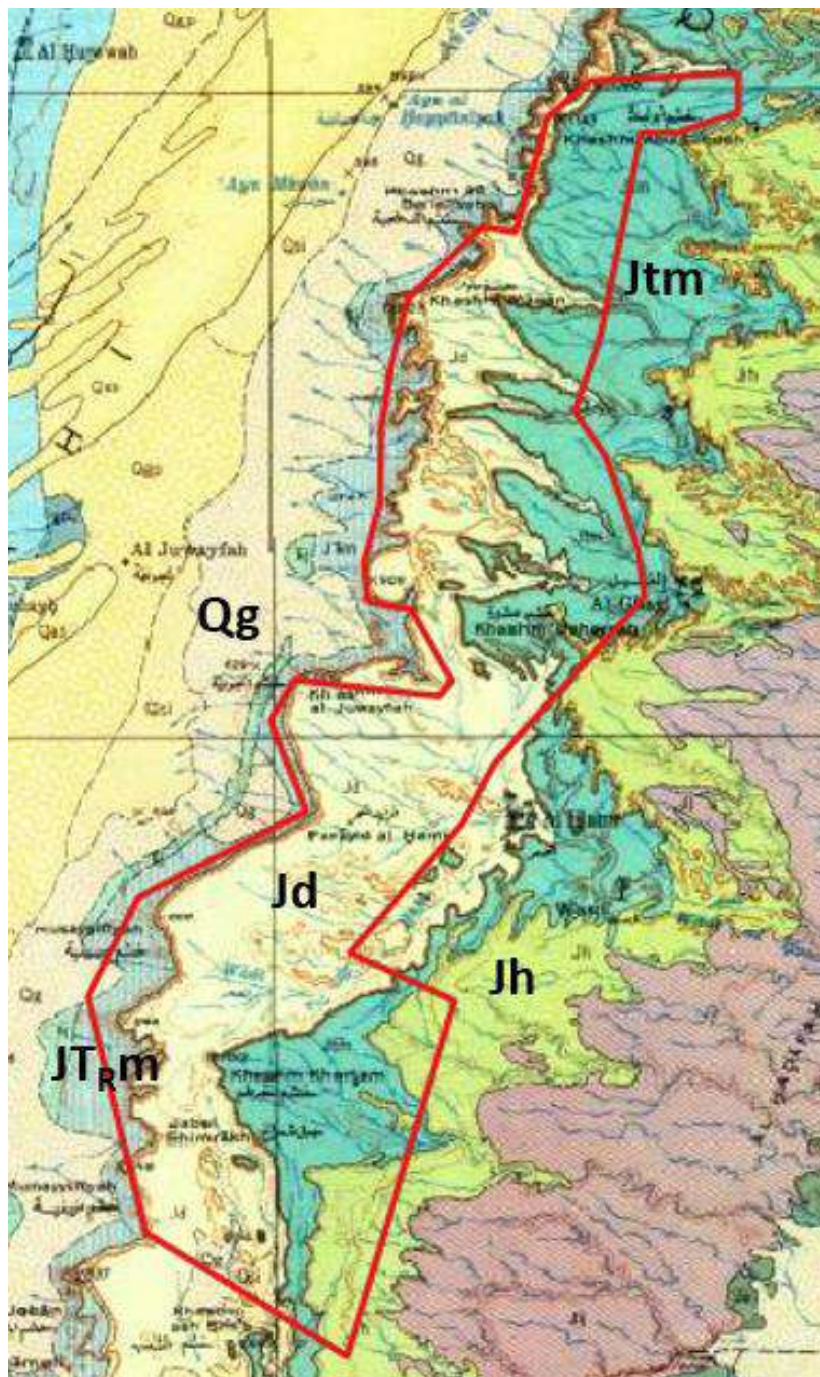


Figure 23: Geology of project area

Qg: Gravel deposits, Quaternary. Surficial deposits of gravel (composed mainly of limestone and other local rocks), sand and silt; in some areas they also include unidentified older gravels. They consist of unconsolidated sediments arranged in plains or depressions. These deposits are only minimally intercepted in the south-western sector of the study area.

Jh: Hanifa Formation, possibly Oxfordian (Upper Jurassic). Cream and tan-coloured soft limestone, minor interbedded marl and tan-coloured clay shale; several brown calcarenite beds are also found (partly oolitic in middle and upper levels). Colonial corals often found in growth

position in the middle and the upper parts of the formation. This material is intercepted in the south-eastern sector of the study area.

Jtm: Tuwayq Mountain Limestone, Callovian (Middle Jurassic). Massive light-coloured compact limestone in which the highest reliefs of Tuwayq Mountains are developed; it includes a basal marly member and, locally, WP7777-TY-WG1-GEN-0001-SR-Prel.Site Asses.Report-D06 Preliminary Studies for WPP in Starah Governorate Page 36 of 59 Preliminary Site Assessment Report

a few thin layers of calcarenites. There are colonial corals in growth position in many levels. Materials widely distributed along the eastern half of the study area except in its central part.

Jd: Dhurma Formation, Bajocian and Bathonian (Middle Jurassic). Light-coloured limestones with interbedded brown calcarenite (partly oolitic); olive-drab clay shale is disposed at the top of the formation. Formation also widely distributed along the study area.

JTRm: Minjur Sandstone, Triassic-Lower Jurassic. Buff-coloured. Usually cross-bedded sandstone with irregularly distributed varicoloured shale, sandy shale and shaly sandstone. Minor beds of ironstone are also found at several horizons. Quartz pebbles are numerous in some sandstone beds. Minjur Sandstone outcrops at the base of the cliff developed in materials from the Dhurma Formation (close to the entire western boundary of the study area).

5.3.6 Soil

5.3.6.1 Soil type

Existing soils are classified as poorly developed semi-desert soils, mostly sand and pebbles, with calcium-rich subsoils. At the project site, soil is often non-existent, and vegetation largely develops on areas of fractured rock, as shown in the figure, other than were frozen rock and winter rains drift into shallow depressions. Even within the valleys, the rare but sporadic flows reveal layers of rocky bedding that are washed away by weather leftovers with each rainy season, leaving little opportunity for soil development.



Figure 24 : Absence of soils in project site

5.3.6.2 Soil analysis

5.3.6.2.1 Soil sample’s locations

To characterize the soil in place, an accredited laboratory was designated to withdraw and analyse ten (10) soil samples from the site.

Location of sampling was fixed to cover at the extent possible the site and represent its soil., as shown in the following figure.



Figure 25 : soil samples location

The coordinates of picked samples are showing in the following table

Table 20 : Soil samples coordinates

Point No.	Long.	Lat.	Point No.	Long.	Lat.
SOIL 1	46.04465266	22.54275696	SOIL 21	45.94138222	22.20888424
SOIL 2	46.01627245	22.5292144	SOIL 22	45.96742719	22.21030094
SOIL 3	46.01511159	22.50974972	SOIL 23	45.98971382	22.2357868
SOIL 4	46.02666862	22.48354854	SOIL 24	45.96167238	22.2512006
SOIL 5	46.042091	22.4413532	SOIL 25	45.98882266	22.26543527
SOIL 6	46.01809042	22.42924743	SOIL 26	46.01978212	22.27048142
SOIL 7	45.9868914	22.41718615	SOIL 27	46.04828148	22.28403695
SOIL 8	45.94856713	22.39518058	SOIL 28	46.07323027	22.30042923
SOIL 9	45.91286153	22.37204743	SOIL 29	46.10240311	22.31332173
SOIL 10	45.92439046	22.34831749	SOIL 30	46.00868418	22.18162383
SOIL 11	45.93354296	22.31888028	SOIL 31	46.05761763	22.07781884
SOIL 12	45.88269287	22.29919954	SOIL 32	46.01119054	22.15097613
SOIL 13	45.91830495	22.28745885	SOIL 33	46.02602319	22.120974
SOIL 14	45.94074939	22.26716335	SOIL 34	46.02832316	22.08383224
SOIL 15	45.91939856	22.24875025	SOIL 35	46.04504996	22.04789968
SOIL 16	45.89241169	22.23239018			
SOIL 17	45.90784609	22.20832533			
SOIL 18	45.92633087	22.18734636			
SOIL 19	45.9173761	22.16394972			
SOIL 20	45.91219744	22.13748864			

5.3.6.2.2 Soil analysis results

Soil analysis results are presented by the following table (analysis results of sample 1. The rest of results are presented in appendices):

Table 21 : soil analysis results

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.23	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1243	n/a
Chloride	EPA 9212	0.01	µg/g	132	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	39.63	n/a
Magnesium	EPA 3050	0.01	µg/g	31.25	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	27.52	n/a
Calcium	EPA 3050	0.01	µg/g	23.63	n/a
Chromium	EPA 3050	0.1	µg/g	3.32	64
Manganese	EPA 3050	0.1	µg/g	1.24	n/a
Iron	EPA 3050	0.01	µg/g	0.22	n/a
Cobalt	EPA 3050	0.1	µg/g	0.96	20
Nickel	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2.34	63
Zinc	EPA 3050	0.01	µg/g	5.23	200
Arsenic	EPA 3050	0.01	µg/g	1.32	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	3.19	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.21	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons (TPH)	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	n/a

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Benzo[a]pyrene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd] pyrene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 - 8270B	0.01	mg/Kg	<0.01	n/a
Benzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Based on the results of the analysis of the previous sample, it was found that soil quality was conform and did not exceed the permissible limits of to the National Center for the Control of Environmental Compliance.

5.3.6.3 Hydrology

The area has the presence of water lines produced by erosive phenomena during episodes of rainfall, which in general will be sporadic in the area.

Given that the location of wind turbines tends to be centered on the highest areas, hydrology has not been considered as an exclusion variable, as it is not considered to be a determining factor for decision-making in this first phase. The water line map obtained is shown below.

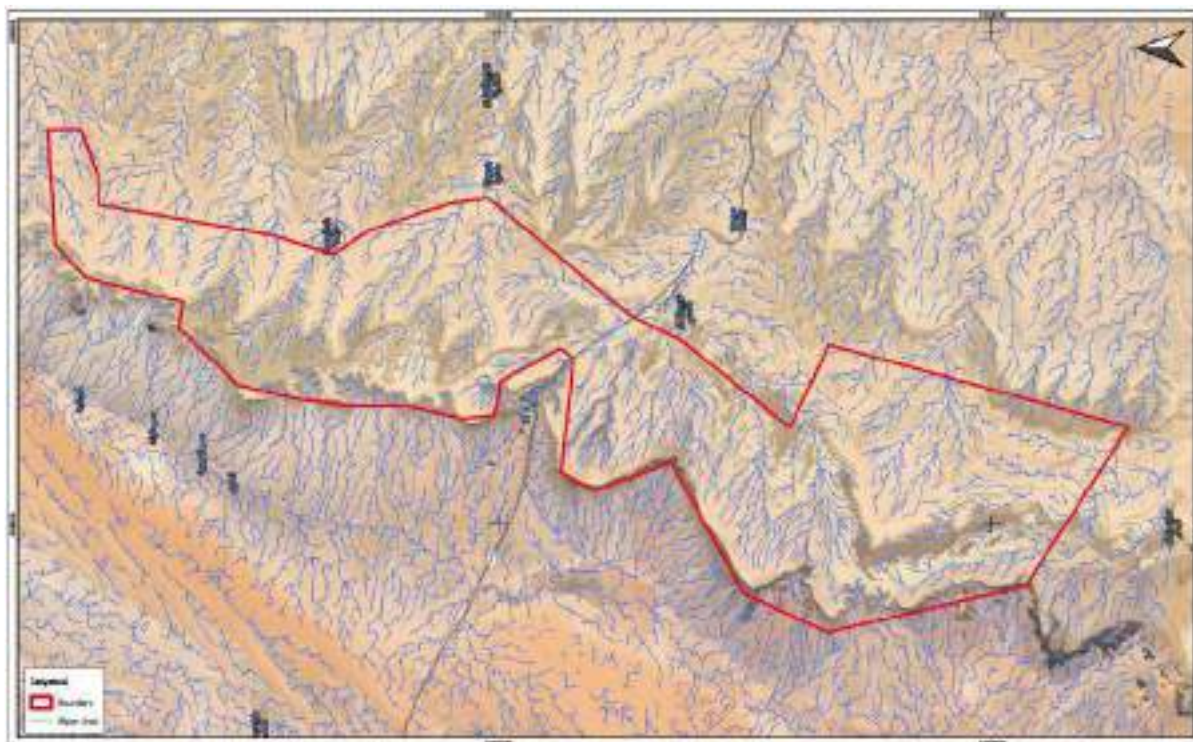


Figure 26 : Water lines map

5.3.7 Groundwater

5.3.8 Aquifers in Saudi Arabia

Groundwater in Saudi Arabia is found almost entirely in the many thick, highly permeable aquifers of large sedimentary basins to the north, east, and groundwater occurs in the fractured, Precambrian crystalline rocks of the Arabian Shield, which is more significant in providing extensive, higher, relatively impermeable areas for surface runoff, and localised, shallow wadi underflow. While the major aquifers in the north of the country consist of multiple, Lower Palaeozoic arenaceous permeable formations with interdigitated impermeable argillaceous strata, those in the eastern part include both karstified Tertiary carbonates and Mesozoic to basal Palaeozoic arenaceous formations. To the south of the Arabian Shelf, a single thick basal Lower Palaeozoic sandstone formation constitutes a high yield aquifer. Groundwater is stored in more than 20- layered principal and secondary aquifers of different geological ages (Figure 38) (Ministry of Agriculture and Water - MAW 1984). The Arabian Shelf includes the deep sedimentary aquifers, which are formed mostly of limestone and sandstone that overlay the basement rock formation known as the Arabian Shield and covers about two thirds of Saudi Arabia or 1,485,000 km² (Ministry of Agriculture and Water 1984). These aquifers crop out in the western parts of the Shelf and extend towards the eastern parts. The total thickness varies between a few hundred to more than 5,000 m (Ministry of Agriculture and Water 1984). The principal aquifers are: Saq, Wajid, Tabuk, Minjur, Dhurma, Biyadh, Wasia, Dammam, Umm Er Radhuma and Neogene. The secondary aquifers are: AlJauf, Al-Khuf, Al-Jilh, the Upper Jurassic, Sakaka, the Lower Cretaceous, Aruma, Basalts and Wadi Sediments (Figure 26). Apart from the last two, groundwater resources stored in these aquifers are non-renewable. The groundwater quality varies between sites and among aquifers (Table 19). The isotopic analyses showed that the fossil groundwater in the above aquifers is 10,000–32,000 years old. Large volumes of groundwater are stored in the sedimentary aquifers (King Fahd University of Petroleum and Minerals, Research Institute 1988). The estimated groundwater reserves to a depth of 300 meters below ground surface is about 2,185 km³, with a total annual recharge of 2,762 Mm³ based on several hydrogeological studies as given in King Fahd University of Petroleum and Minerals and Research Institute (1988) (Table 19). Renewable groundwater resources are mainly stored in the shallow alluvial aquifers and within Basalts, which extend mostly in the south-western parts of Saudi Arabia with varying thickness and width (MAW 1990). These aquifers store about 84,000 Mm³, with an average annual recharge of 1,196 Mm³ (British Arabian Advisory Company - BAAC 1980). The total national groundwater reserves in the shallow and deep aquifers to a depth of 300 m below ground surface is about 2,259 km³. These volumes of renewable and non-renewable groundwater resources represent a dependable source for different purposes, including irrigation in the Kingdom, if properly managed.

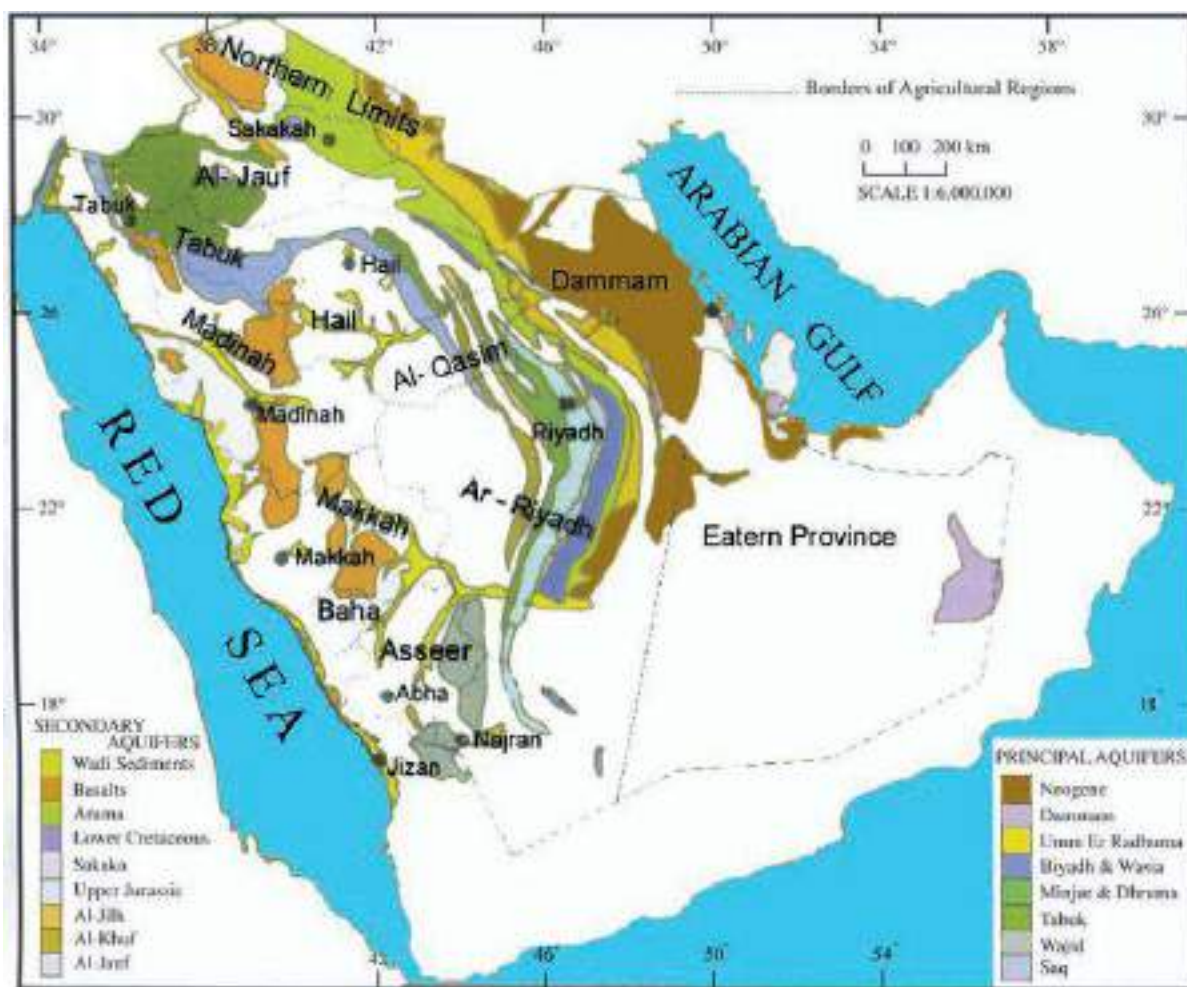


Figure 27: The extension of the outcrop areas of principle and secondary aquifers

Table 22: The estimated groundwater reserves in Saudi Arabia to a depth of 300 meters below ground level in Mm³

Aquifer	Reserve (Mm ³)	Recharge (Mm ³)	Total dissolved solids (ppm)
Saq	290,000	310	300–3,000
Tabuk	210,000	455	250–2,500
Wajid	220,000	104	500–1,200
Minjur- Dhurma	180,000	80	1,100–20,000
Wasia- Biyadh	590,000	480	900–10,000
Umm Er Radhuma	190,000	406	2,000–5,000
Dammam	45,000	200	2,600–6,000
Khuf & Tuwal	30,000	132	3,800–6,000
Aruma	85,000	80	1,600–3,000

Aquifer	Reserve (Mm ³)	Recharge (Mm ³)	Total dissolved solids (ppm)
Jauf & Sakaka	100,000	95	400–5,000
Jilh	115,000	60	3,800–5,000
Neogene	130,000	360	2,400–4,000
Total	2,185,000	2,762	

5.3.8.1 Delimitation of Saudi Arabia aquifers

Aquifers covering the Saudi Arabia area are shown in the figure below

5.3.8.2 Aquifer covering the project area

The project site is located on the aquifer of Wajid as shown in the figure 21

5.3.8.2.1 Aquifer location

The Wajid Aquifer System is located at the edge of the crystalline Arabian Shield near the southwestern tip of the Arabian Peninsula (see Overview Map). It extends across the border of Saudi Arabia and Yemen.

The Wajid Aquifer System extends over an area of more than 455,000 km² of which 26,300 km² is covered with outcrops. Around 307,000 km² is located in Saudi Arabia, and the remaining 146,000 km² is in Yemen. Recent data¹ from deep exploratory wells suggests that the aquifer system extends over a much larger area than previously estimated.² A recent study found that the subsurface extent of the sandstones reaches the eastern shores of the Arabian Peninsula.³ The aquifer system is bounded by the Asir-Yemen Highlands to the west, the vast Rub' al Khali Desert to the east, the Ramlat es Sab'atayn Desert-Hadhramaut Plateau to the south, and the Najd Plateau to the north.

5.3.8.2.2 Aquifer geometry

The Wajid Sandstones are made up of two permeable formations, the Upper and Lower Wajid Sandstones, which are separated by a less permeable shale formation. Geo-structural and physiographic features were used to approximate the boundaries of this system, which comprises 4 hydraulically connected layers. It is mostly confined although some parts are unconfined. The thickness of the aquifer system, including aquitards, varies from 100m to 900m.

5.3.8.2.3 Hydrogeological aspects

The predominant aquifer lithology consists of sedimentary rock – sandstones. System replenishment from natural sources is very low to low (0-20 mm/annum), amounting to about 175 Mm³/annum to 240 Mm³/annum of freshwater recharge. This natural recharge water percolates through an area of approximately 26 000 km². The primary type of porosity is predominant that allows low vertical connectivity between layers. Transmissivity across the Aquifer States ranges between 50 m²/d and 7000 with an average of 1 300 m²/d.

5.3.8.2.4 Linkages with other water systems

Recharge occurs via runoff and flash floods in a network of wadi channels descending from the Asir Mountains. Discharge occurs in the form of sabkhas along fracture zones inside Saudi Arabia.

5.3.8.2.5 Environmental aspects

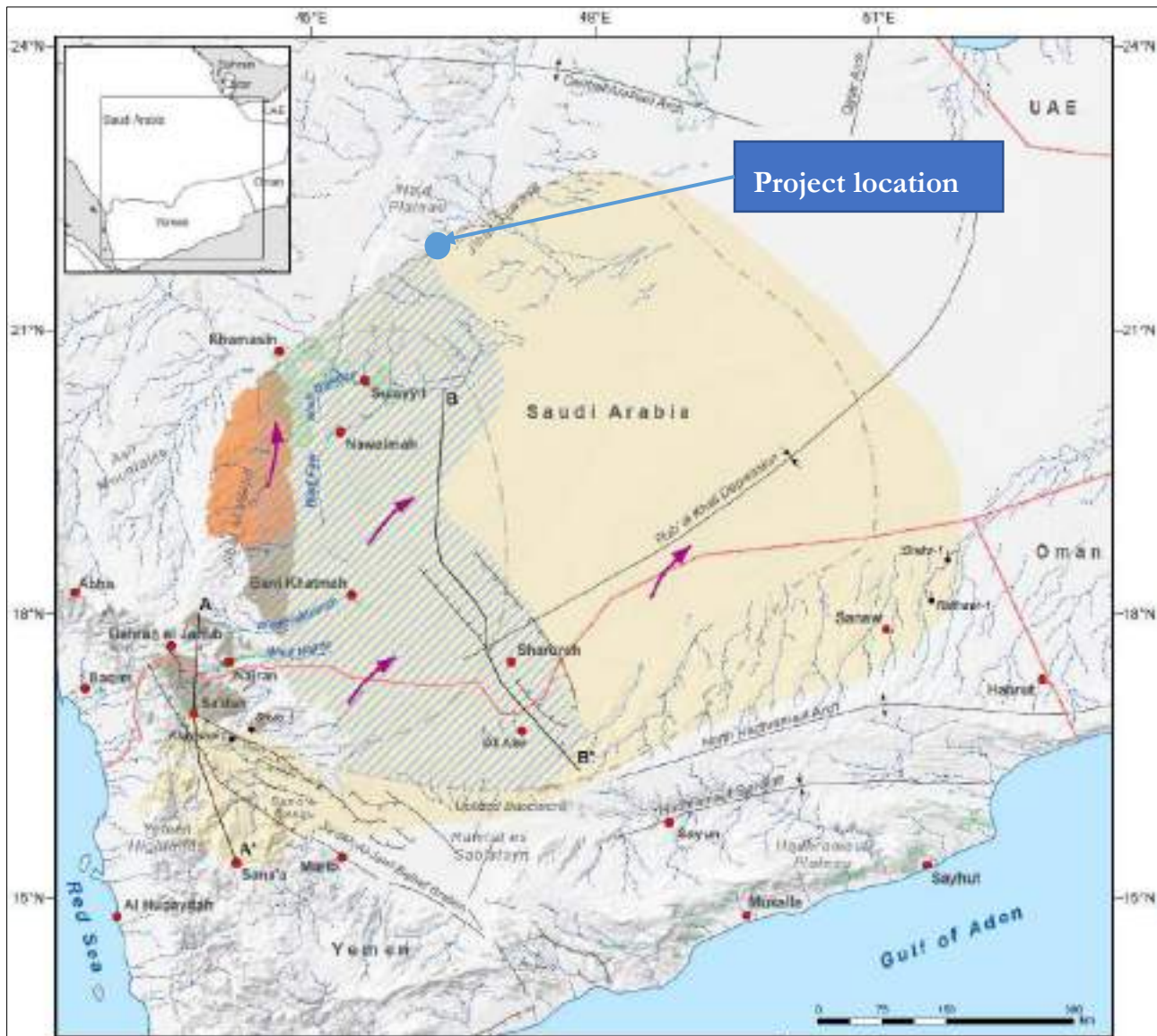
Groundwater is fresh to slightly brackish (700-1000 mg/l TDS) and only in about 5% of aquifer area quality does not satisfy local drinking water standards. Superficial layers of the aquifer system are vulnerable to pollution from agricultural practice and salinization, nitrogen species and pesticides are the most important pollutants affecting groundwater quality.

5.3.8.2.6 Socio-economic aspects

A total of 2400 Mm³/annum of groundwater is abstracted, mainly in Saudi Arabia and predominantly for agricultural use.

5.3.8.2.7 Hot spot

This system has been heavily exploited in certain areas that will soon be economically exhausted, as predicted by a number of studies. In addition, groundwater may contain significant amounts of radionuclides of natural origin that are potentially hazardous to human health. A thorough study and assessment of the current conditions of groundwater in the system, in terms of both quantity and quality, becomes a priority. Joint monitoring and management of the over-exploited aquifer system under a bilateral agreement is essential.



Wajid Aquifer System



Figure 29: Wajid aquifer system map

5.3.9 Historical and cultural heritage

As for the cultural heritage limitations, the project site is far from the historical and cultural sites in the Kingdom, where the UNESCO World Heritage List was reviewed to confirm, with the analysis of both the places currently included in the World Heritage List and the places with nominations for examination by the World Heritage Committee as well as the Tentative List, in order to Consider any site of cultural or natural interest. The World Heritage List in Saudi Arabia is shown in the below table.

Table 23 : World Heritage Tentative List by UNESCO

Picture	The name	the site	Registration year	the number	Type
	Zubaydah's path (The pilgrimage route from Kufa to Mecca)	Northern Border District Hail region Qassim region Medina area Makkah Region	2015	6025	cultural
	Hejaz Railway	Tabuk region Medina area	2015	6026	cultural
	Shami Hajj Road	Tabuk region Medina area Makkah Region	2015	6027	cultural
	Egyptian pilgrimage route	Tabuk region Medina area Makkah Region	2015	6028	cultural
	The ancient village of Al- Faw	Riyadh region	2015	6029	cultural
	Rijal Almaa Heritage Village	Asir region	2015	6030	cultural

Picture	The name	the site	Registration year	the number	Type
	Dhi Ain Heritage Village	Al Baha area	2015	6031	cultural
	The historical oasis of Dumat Al-Jandal (Al-Dir` neighborhood in Dumat Al-Jandal)	Al-Jawf region	2015	6034	cultural
	Uruq Bani Maarid Reserve	Najran Province Riyadh region	2019	6369	natural
	Farasan Islands Reserve	Jazan region, the south-eastern part of the Red Sea	2019	6370	Natural

Table 24 : World Heritage List by UNESCO

Picture	Name	Registration year	Site	Notes	Number	Type
	Al Hajar (Madain Saleh)	2008	Medina area 26°47'1"N 37°57'18"E	It was one of the cities of the Nabataean kingdom. The mission is in the north of the Arabian Peninsula and the stone is the name of Thamud homes. The site includes huge tombs, dating back to the first century BC. It also includes about 50 inscriptions dating back to that period, and a number of cave drawings.	1293	cultural
	At-Turaif neighborhood in Diriyah	2010	Riyadh region 24°44'3"N 46°34'21"E	Its dwellings are distributed on the banks of Wadi Hanifa And its tributaries, and its ancient wall is surrounded by its fortifications and mud towers, and Diriyah was the first capital of the Al Saud family.	1329	cultural
	Historic Jeddah	2014	Makkah Region 21°29'N 39°12'E	Historic Jeddah (Al-Balad) is located in the center of the city of Jeddah, and includes a number of monuments and archaeological and heritage buildings, such as the Jeddah wall and its historical lanes, as well as a number of historical mosques.	1361	cultural

Picture	Name	Registration year	Site	Notes	Number	Type
	Rock arts in the Hail region(mealAnd Shuwaimis)	2015	Hail region 28°00'N 40°54'E	Rock art in the Hail region includes drawings of Jabal Umm SinmanIn Jubbet Warrat and Al-Manjour in Shuwaymis. Jabal Umm Sinman was a lake at an earlier time, and its inhabitants left many inscriptions about their lives. As for Rat and Al-Manjour, they were two valleys, and the inscriptions in them show drawings of humans and animals dating back ten thousand years.	1472	cultural
	Al-Ahsa Oasis	2018	Eastern Region 25°24'7"N 49°37'50"E	The oasis is located in Al-Ahsa GovernorateMore than a million and a half palm trees grow there, and it is the largest palm oasis surrounded by sand in the world. Extensive agricultural works are held next to it, due to the abundance of water and fresh springs. The site includes several landmarks, namely: Jawathi Mosque, Ibrahim Palace, Sahoud Palace, Muhairis Palace, Abu Jalal Palace, Al-Aqeer Port, Qara Mountain, Al-Qaysaria Market.	1563	cultural

Picture	Name	Registration year	Site	Notes	Number	Type
	cultural fever area	2021	Najran Province		1619	cultural

These sites are listed above to demonstrate that are far away from the project site. the project site is located out of influence of these monuments, and it doesn't have any interference with them nor with their buffer zones.

5.3.10 Ambient air quality

5.3.10.1 Measurement methods

AH Environmental Consultancy has engaged an accredited laboratory to undertake to air quality measurements for the Environmental Monitoring for Starah Project. The laboratory team moved to make the required measurements, namely (Air Quality Measurements), the most recent devices approved by the NCEC were used.

The project site was visited by the work team in order to assess the air quality in the work environment at the site and the surrounding environment to determine the extent of the impact of works inside the site on the environment surrounding the project. The standard methods approved by NCEC were followed.

5.3.10.2 Methodology for locating Air Measurements

The measurement methodology for air samples inside the site is based on the selection of suitable sites for air sampling to be representative, expressive and accurate representation of the site, taking into account the direction of the wind for each point selected, to determine the effects resulting in the site and the role of wind in transferring emissions from surrounding facilities to the site environment.

5.3.10.3 quality of results

the engaged accredited laboratory follows an accurate and high-quality system in conducting its environmental measurements. The measuring devices are calibrated according to a periodic preprepared program. The measurements obtained by these devices are compared to measurements obtained by of other accredited laboratories to evaluate the accuracy of the results.

The accredited laboratory follows (ISO 17025/2008) system for laboratory quality. The readings, calculation of averages and the standard deviation rate are taken and compared to the quality scheme of each device to identify the systematic error and evaluate the random error and reduce each of them by comparing the results of the devices with the results of other accredited parameters to evaluate the accuracy of the results.

5.3.10.4 Equipment

The characteristic of the devices used for assessing the air quality is given by then following table.

Table 25 : Equipment used for measuring four points at The Site

Items	Description	Specification
Particle Modules PM	Monitor method	Continuously, automatically and real-time
	Working principle	Light scattering technique
	Measurement data	PM2.5, PM10
	Measuring range	0 10mg/m3
	Response time	60s
	Measuring time	1min(Standard measurement time)
	Minimum detection limit	0.001 mg/m3
	Instrument parallelism	10%
	Data validity	>75%
	Dehumidification	With the automatic dehumidification function module
	Alarm function	With high concentration alarm function, the platform can configure the alarm threshold
Gas modules	Monitor method	Continuously, automatically and real-time
	Working principle	High precision Electrochemical sensor
	Gas monitor	SO2,H2S, NO2, CO, O3
	Sulfur Dioxide SO2	Measuring range: 0 2000ppb Resolution: 1ppb / Response time: <45s
	Sulfur Dioxide H2S	Measuring range: 0 2000ppb Resolution: 0.1ppm / Response time: <45s
	Ozone O3	Measuring range: 0 20000ppb Resolution: 5ppb / Response time: <45s
	Carbon Monoxide CO	Measuring range: 0 200ppm Resolution: 0.1ppm / Response time: <45s
Meteorological parameters	Temperature: Measuring range: - 40 60 , Precision: 0.3 (20)	
	Humidity: Measuring range: 0 100%RH, Precision: 2%(5%RH 95%RH, 25)	
	Wind direction: Measuring range: 0 360°, Precision: 5°	
	Wind speed: Measuring range: 0 30m/s, Precision: 0.3m/s	
	Barometric pressure: Measuring range: 30 110Kpa, Precision: 2.5pa	

5.3.10.5 Methodology adopted

5.3.10.5.1 Methodology for using AQMS for Outdoor Air Quality measurements.

The AQMS Air Quality Monitoring Station can measure outdoor air pollutants in real-time, quickly and accurately. It can be customized for different application demand. The following parameters can be measured:

- the Gas type Ozone(O₃),
- Nitrogen Dioxide (NO₂),
- Sulfur Dioxide (SO₂), Carbon Monoxide (CO),
- Particulate matter PM_{2.5} and PM₁₀.

5.3.10.5.2 Monitoring and Data Collection

The location coordinates of the indoor air quality monitoring stations are as shown in the table below. The station location and siting were chosen by AH environmental consultancy and were intended to provide indoor air quality data for the site.

Table 26 : Coordinates of air quality measurement points

Point	Latitude	longitude
AQM1	46.014031°	22.514491°
AQM2	45.910682°	22.373350°
AQM3	45.921730°	22.177225°
AQM4	46.015642°	22.080962°
AQM5	45.961225°	22.261272°



Figure 30 : Air quality measurement points locations

5.3.10.5.3 Data Acquisition

Data acquisition was performed by using a Personal Computer based data logger situated at AQMS in monitoring sites. Data were saved every hour (hourly average). The data were backed up and downloaded every day and were subjected to a rigorous program of quality check.

5.3.10.5.4 Data Validation and Reporting

The accredited laboratory maintains distinct databases containing non-validated and validated data respectively. The validated database is created by duplicating the non-validated database and then flagging data affected by instrument faults, calibrations and other maintenance activities. Invalid data is removed with the support of valid reason (e.g., supported by maintenance notes, calibration sheets etc. as documented in exception tables). Validation is performed by a trained data analyst. All data is checked and reviewed by the laboratory's head section. Graphs and reports are generated based on the validated hourly data and daily data.

5.3.10.5.5 Air Quality Limit Values

Air quality data of Air Quality Monitoring Station have been compared with the NCEC 2014 indoor air standards.

5.3.10.5.6 Calibration

Multipoint calibration of the instruments monitoring gaseous pollutants was conducted before installation at both locations successively. The instruments were calibrated in full accordance with the manufacturer's recommendations and conform to the requirements of United States

Environment Protection Agency SEPA. Calibrations were performed at the monitoring site by allowing the analyzer to sample a gaseous standard containing a known pollutant concentration.

5.3.10.6 Results

The results are shown in tables below. it was found that there are no diffractions in any of them, the standards of the General Authority for Meteorology and the NCEC.

5.3.10.6.1 Results for SO₂

Table 27 : summary of SO₂ results 24 hours (hourly data)

SO ₂	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m ³
Hourly Min ppb	1656	1.526	1.302	1.425	1.323	24 hrs 217
Hourly Max ppb	2.496	2.423	1.220	2.656	2.325	
Average	2.231	1.956	1.748	2.114	1.816	

From the above results, it was found that there is no deviation in the results of sulphur dioxide according to the standards of the National Center for the Control of Environmental Compliance (NCEC Standards).

5.3.10.6.2 Results for NO

Table 28 : Summary of NO results 24 hours (hourly data)

NO	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m ³
Hourly Min ppb	6.22	6.53	4.15	4.25	5.963	-----
Hourly Max ppb	28.15	28.95	25.94	25.63	27.63	
average	17.32	17.95	15.66	15.21	16.624	

From the above results, it was found that there are no limits in the results of nitrogen oxide according to the standards of the National Center for Monitoring Environmental Compliance

5.3.10.6.3 Results for NO₂

Table 29 : Summary of NO₂ results 24 hours (hourly data)

NO ₂	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m ³
Hourly Min ppb	34.96	30.69	28.36	27.25	31.25	1hr 200
Hourly Max ppb	68.95	64.5	62.14	60.22	66.41	
average	55.17	50.24	47.96	45.96	52.30	

From the above results, it was found that there is no deviation in the results of nitrogen dioxide according to the standards of the National Center for the Control of Environmental Compliance (NCEC) Standards.

5.3.10.6.4 Results for NO_x

Table 30 : Summary of NO_x results 24 hours (hourly data)

NO _x	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m ³
Hourly Min ppb	44.69	39.69	35.27	37.45	40.25	-----
Hourly Max ppb	86.58	81.54	76.93	79.35	83.29	
average	70.19	64.98	60.04	63.12	66.62	

From the above results, it was found that there are no limits in the results of Nitrogen Oxides according to the standards of the General Authority for Meteorology and Environmental Protection (NCEC Standards).

5.3.10.6.5 Results for CO

Table 31 : Summary of CO results 24 hours (hourly data)

CO	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m ³
Hourly Min ppb	0.393	0.284	0.384	0.325	0.3145	8hr 10000
Hourly Max ppb	0.364	0.354	0.514	0.482	0.4621	
Average	0.384	0.325	0.395	0.396	0.384	

From the above results, it was found that there is no deviation in the results of Carbon Monoxide according to the standards of the National Center for the Control of Environmental Compliance (NCEC Standards).

5.3.10.6.6 Results for H2S

Table 32 : Summary of H2S results 24 hours (hourly data)

H2S	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m3
Hourly Min ppb	0.262	0.195	0.174	0.154	0.18719	24hrs 200
Hourly Max ppb	1.21	1.15	0.902	0.726	0.9632	
Average	0.825	0.612	0.399	0.385	0.412	

From the above results, it was found that there is no deviation in the results of Hydrogen Sulphide gas according to the standards of the National Center for the Control of Environmental Compliance (NCEC Standards).

5.3.10.6.7 Results for O3

Table 33 : Summary of O3 results 24 hours (hourly data)

O3	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m3
Hourly Min ppb	7.45	4.35	4.75	6.39	5.36	8hrs 157
Hourly Max ppb	28.96	24.11	24.83	28.5	26.36	
Average	18.86	14.82	15.20	17.96	16.22	

From the above results, it was found that there is no deviation in the results of Ozone gas according to the standards of the National Center for the Control of Environmental Compliance (NCEC Standards).

5.3.10.6.8 Results for PM10

Table 34 : Summary of PM10 results 24 hours (hourly data)

PM10	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit µg/m3
Hourly Min ppb	97.8	93.66	96.84	95.69	92.33	24hrs

PM10	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit $\mu\text{g}/\text{m}^3$
Hourly Max ppb	82.5	178.14	81.6	179.6	176.52	340
average	143.59	135.9	140.9	137.96	133.86	

From the above results, it was found that there is no deviation in the results of particles with aerodynamic diameters less than 10 microns (PM10) according to the standards of the National Center for Environmental Compliance Control (NCEC Standards).

5.3.10.6.9 Results for PM2.5

Table 35 : Summary of PM2.5 results 24 hours (hourly data)

PM2.5	AQM1	AQM 2	AQM3	AQM4	AQM5	NCEC Limit $\mu\text{g}/\text{m}^3$
Hourly Min ppb	29.86	27.69	26.59	29.65	27.33	24hrs 35
Hourly Max ppb	33.62	32.093	30.45	32.63	31.258	
Average	31.99	31.25	28.14	30.95	29.31	

From the above results, it was found that there is no deviation in the results of particles with aerodynamic diameters less than 2.5 microns (PM2.5) according to the standards of the National Center for Environmental Compliance Control (NCEC Standards).

According to all measures effectuated on air quality, we Can confirm that ambient air quality in the site is in conformity with NCEC limits.

5.3.10.6.10 Results for temperature humidity, direction, and speed of wind

Table 36 : Summary of Temperature results 24 hours (hourly data)

Temperature	AQM1	AQM 2	AQM3	AQM4	AQM5
Hourly Min ($^{\circ}\text{C}$)	12	10.5	10	11	10
Hourly Max ($^{\circ}\text{C}$)	24	23	23	22	22
average	17.8	16.9	16	16.5	15.95

Table 37 : Summary of Humidity results 24 hours (hourly data)

Humidity	AQM1	AQM 2	AQM3	AQM4	AQM5
Hourly Min (%)	25	24	26	26	24
Hourly Max (%)	44.1	42.5	43	44	42
Average (%)	33	33.1	34.2	33.6	32.25

Table 38 : Summary of wind direction results 24 hours (hourly data)

Wind Direction	AQM1	AQM 2	AQM3	AQM4	AQM5
Hourly Min (°)	149	146	142	145	139
Hourly Max (°)	340	336	328	332	324
Average (°)	251.4	247	244.9	243.5	239.24

Table 39 : Summary of wind Speed results 24 hours (hourly data)

Wind speed	AQM1	AQM 2	AQM3	AQM4	AQM5
Hourly Min (m/s)	14	12	11	13	13
Hourly Max (m/s)	27.8	26.8	26.1	27.5	27
Average (m/s)	22.4	20.9	20.5	22	21.6

5.3.11 Ambient noise

5.3.11.1 Methodology of noise monitoring

Baseline environmental noise measurements were conducted at four (04) locations in the project site as required by the contract. the three points have been set to cover the project area to the extent possible (see figure below).

Measures were undertaken by the device “Cirrus Optimus sound level meters instrument (CK: 1720 kit)” which is approved by the NCEC Control and compliant with the requirements of the Environmental Protection Agency (EPA).

The microphone was placed on a tripod, at a height of 1.5 m above ground level under free-field conditions.

The attended survey collected continuously sound level data during one half an hour to one hour on morning, and on late evening as required by the NCEC to gain a realistic understanding of baseline sound on the development site.

As the project site is located far from any human settlement and only adjacent roads will be impacted by the noise. The noise level limits adopted are those dictated by NCEC standards for noise levels in proximity of roads.

Table 40 : Noise measurement points coordinates

Point	longitude	Latitude
Noise 1	22.513065°	46.014101°
Noise 2	22.371883°	45.910473°
Noise 3	22.180195°	45.919423°
Noise 4	22.080011°	46.008966°



Figure 31 : Points of noise measurement location

5.3.11.2 Results of noise measurement

The results of measures are given by the following table.

Table 41 : Noise intensity in measurement points in the site

Point	Time	LAeq	LAFMax	LA10	LA90	NCEC LIMIT
NOISE 1	08:00- 09:00 AM (Day time)	52.6	65	51.2	45.5	70
	20:00 -21:00 PM (Evening)	50.7	62.5	49.3	43.5	65
NOISE 2	08:00- 09:00 AM (Day time)	54.5	66.7	52	44.6	70
	20:00 -21:00 PM (Evening)	53.4	65.8	51.8	43.9	65
NOISE 3	08:00- 09:00 AM (Day time)	55	67.1	54	43.2	70
	20:00 -21:00 PM (Evening)	53.6	63.4	50.7	44.8	65
NOISE 4	08:00- 09:00 AM (Day time)	58.6	67.5	52.9	45.5	70
	20:00 -21:00 PM (Evening)	54	64.3	52.8	45.9	65

From the results shown above, it was found that the noise intensity values at the points in the site did not exceed the permissible limits according to the executive regulations of the NCEC nor the IFC guidelines.

5.4 Ecology and Biodiversity (Except birds and bats)

5.4.1 Introduction

A biodiversity assessment was carried out for Starah Wind Power plant site (henceforth referred to as 'the Project Site) to characterize the ecological features and identify any biodiversity elements that require special consideration during the development stages of the project.

5.4.2 Project Site boundaries identification

Project site has a surface area of approximately 230 Km² and is located roughly around 135 Km southwest of the town of Hawtat Bani Tamim (se figure below).

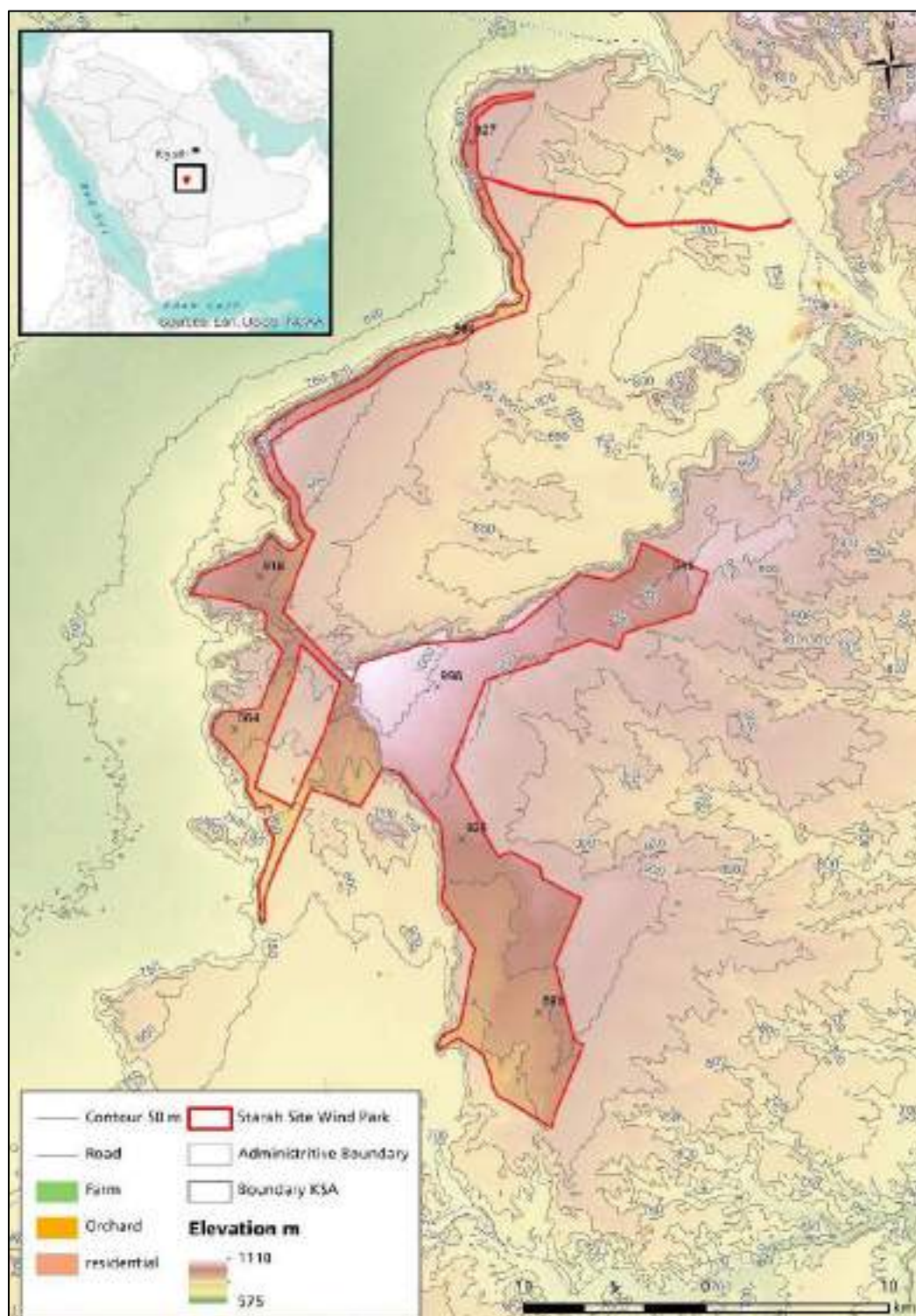


Figure 32 : Project Site boundaries and location

5.4.3 Objective

The ecological walkover survey was undertaken at the Project Site in order to document ecological features (flora, fauna, and habitat/landscape).

Items recorded during the survey included the following:

- Landscape features.
- Flora species.
- Fauna species, including avifauna, and any relevant signs.
- Land use features (human settlements, domestic animals, agricultures etc.).

5.4.4 Methodology

The biodiversity assessment would cover general ecology, biogeography and habitats in addition to flora (annual and perennial) and fauna (mammals, herpetofauna, avifauna and macro-invertebrates). The assessment aims to identify any ecologically sensitive areas in the study area and its surroundings, including Key Biodiversity Areas (KBAs), which include Important Bird Areas (IBAs).

Based on the results of the assessment, potential impacts of the project on all biodiversity will be analyzed outlining those potential impacts at the various development stages of the project. Following up on the potential impacts, mitigation and monitoring measures will be provided.

The assessment methods of the Project Site are divided into two main parts: a comprehensive literature review and a field survey.

5.4.4.1 Desktop Review

This is based on previous studies, data, surveys, and records available in published scientific papers, books, and journals on biodiversity recorded within the study region in general. It is important to note that since the available literature on the Project site and its vicinity is relatively limited, the literature reviewed will include a wide spectrum of references including international references that have a wider focus than the area of the Project.

As part of the desktop assessment, habitat mapping and assessment was undertaken in order to identify any areas of conservation sensitivity present. Integrated Biodiversity Assessment Tool (IBAT) will be referred to in order to identify all sites of biodiversity importance (Key Biodiversity Areas) and Protected Areas. In compliance with IFC's PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources, the review of IBAT will identify the need to undertake a Critical Habitat Assessment (CHA). As defined by PS6, critical habitats are 'areas with high biodiversity value, including (i) *habitat of significant importance to*

Critically Endangered and/or Endangered 11 species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

Being a wind energy project, more focus was given to the location of the Project Site in reference to Migratory Soaring Birds (MSBs) and any potential resident and/or breeding large-sized bird present in the vicinity of the Project Site. Consequently, specific recommendations is provided in relation to pre-construction monitoring to be undertaken, especially during migration seasons.

Based on this, it was crucial to undertake this desktop exercise at an early stage of the assessment in order to identify if there is a need to carry out a Critical Habitat Assessment or not at the Project Site. Also, on the habitat level, priority ecoregions of global conservation were investigated for its presence at the project areas according to Olson et al (2003).

5.4.4.2 Field Survey

A comprehensive field survey was undertaken at the Project site, while documenting ecological field observations. The site was examined carefully for the presence of active animals, animal signs and tracts, active burrows, remains or any other vital signs that indicate the activity of animals. In addition, the site was surveyed for occurring plant species, which were noted and recorded to include number of species, coverage per species, etc. Routes of inspection were spread out across the project area to provide a comprehensive representation. Additionally, any areas that were identified as areas of special interest was visited and their biodiversity was recorded. Finally, any accidental records of any species at the Project Site were added into the list of species recorded.

Items recorded during the survey will include the following:

- Landscape features.
- Flora species.
- Fauna species, including avifauna, and any relevant signs
- Land use features (human settlements, domestic animals, agricultures etc.).

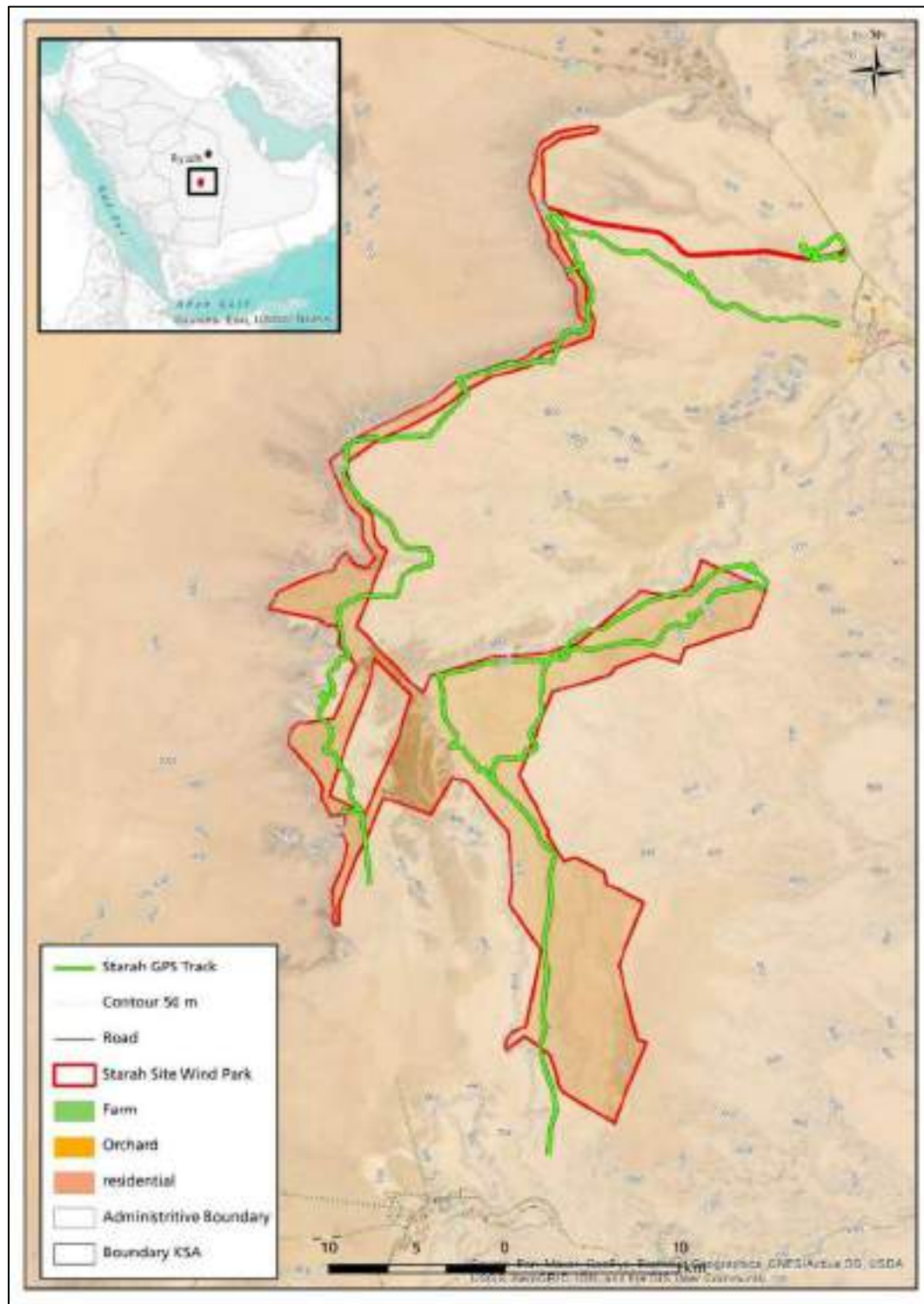


Figure 33: Route of inspection during the survey

5.4.5 Results

5.4.5.1 Habitats and Flora

5.4.5.1.1 Desktop Review

The Project Site is part of the Arabian Desert Ecoregion (Olson et al, 2001), which is part of the Desert and Xeric Shrublands Biome under the Palearctic Realm (Figure 20 (right)). From a biogeographical perspective, the Project Site has its vegetation type described as 'very open xeromorphic dwarf-shrublands, rock and gravel deserts that are part of the 'Deserts and other scarcely vegetated areas of the Arabian Peninsula' (Ghazanfar & Fisher, 1998). One characteristic features the Project Site, and its surroundings are the wide shallow wadi communities crossing through the open desert (Figure 20 (left)).

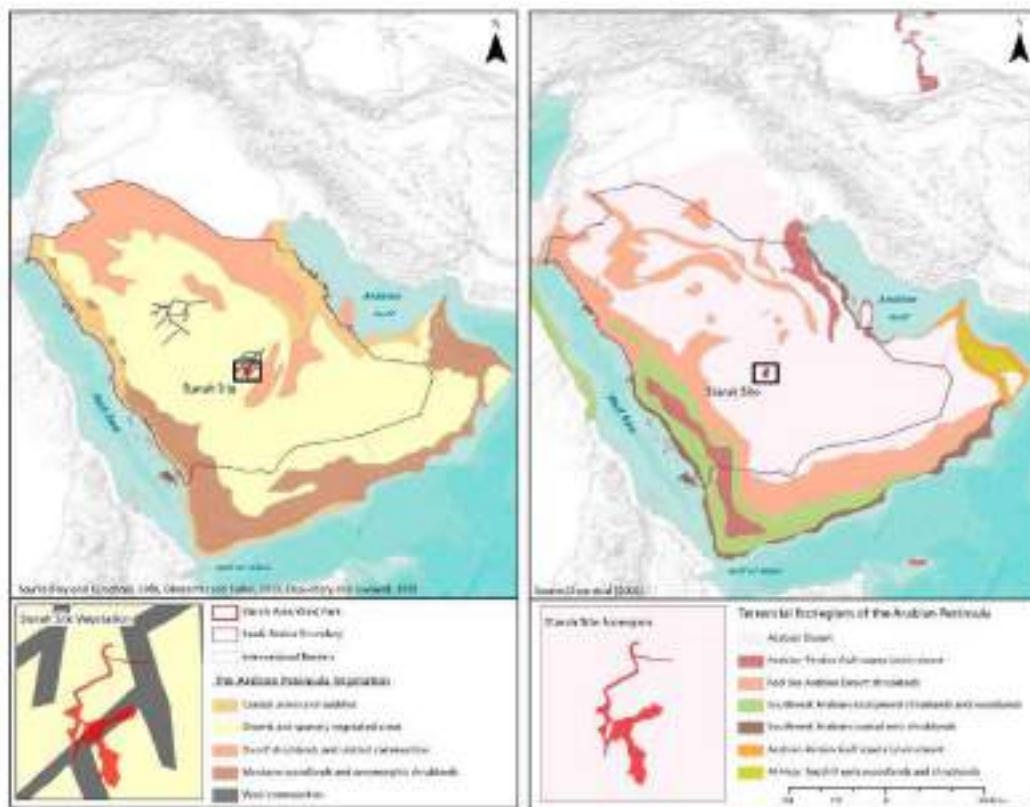


Figure 34: Location of the Project Site in the Deserts and sparsely vegetated Area (Ghazanfar & Fisher, 1998) (left), and the location of Project Site in the Arabian Desert (Olson et al, 2001) (right).

5.4.5.1.2 Field Survey

Based on the field survey, the Project Site is located across a network of seasonal runoff wadis that flow westward making part of Jabal Twwayg (Jebel Tuwaiq), which is a narrow escarpment separating Najd Plateau in the north from the Empty Quarter (Al-Rub' Al-Khali) in the south. The Project Site extends for more than 55km from north to south along the escarpment. Vegetation is scarce in general but dense concentration can be found along the runoff wadis that are dominated by *Vachellia tortilis*, see Figure 34.

Annual species were recorded across the Project Site were limited to grass species *Stipagrostis plumosa*, while perennial plant species recorded were limited to six species, see Table 39 and Figure 35. *Vachellia tortilis* was by far the highest recorded since it is the dominant species along the main wadi crossing through the Project Site. The second most commonly recorded species was *Maerua crassifolia*, which is additionally is the only species of High Conservation Priority (HCP) encountered, see Figure 36. The other species were recorded scarcely.

Table 42 : Flora Species Recorded on Site

Family	Name	Type	DAFOR	Endemism / Status	IUCN Threatened Species Status (2022)
Apocynaceae	<i>Calotropis procera</i>	Shrub	R	Native	Not Evaluated (NE)
Capparaceae	<i>Maerua crassifolia</i>	Tree	R	Native	Least Concern
Cucurbitaceae	<i>Citrullus colocynthis</i>	Shrub	R	Native	Not Evaluated (NE)
Fabaceae	<i>Vachellia tortilis</i>	Shrub	O	Native	Least Concern (LC)
Graminae	<i>Stipagrostis plumosa</i>	Grass	R	Native	Not Evaluated (NE)
Peraceae	<i>Clusia lanceolata</i>	Shrub	R	Native	Not Evaluated (NE)
Zygophyllaceae	<i>Tetraena coccinea</i>	Shrub	R	Native	Not Evaluated (NE)



Figure 35: Contrast in vegetation cover between the runoff wadis dominated by *Vachellia tortilis* and the arid gravel desert



Figure 36 : *Maerua crassifolia*, the only High Conservation Priority Plant Species recorded at the Project Site; the specimen on the left showing signs of intensive grazing

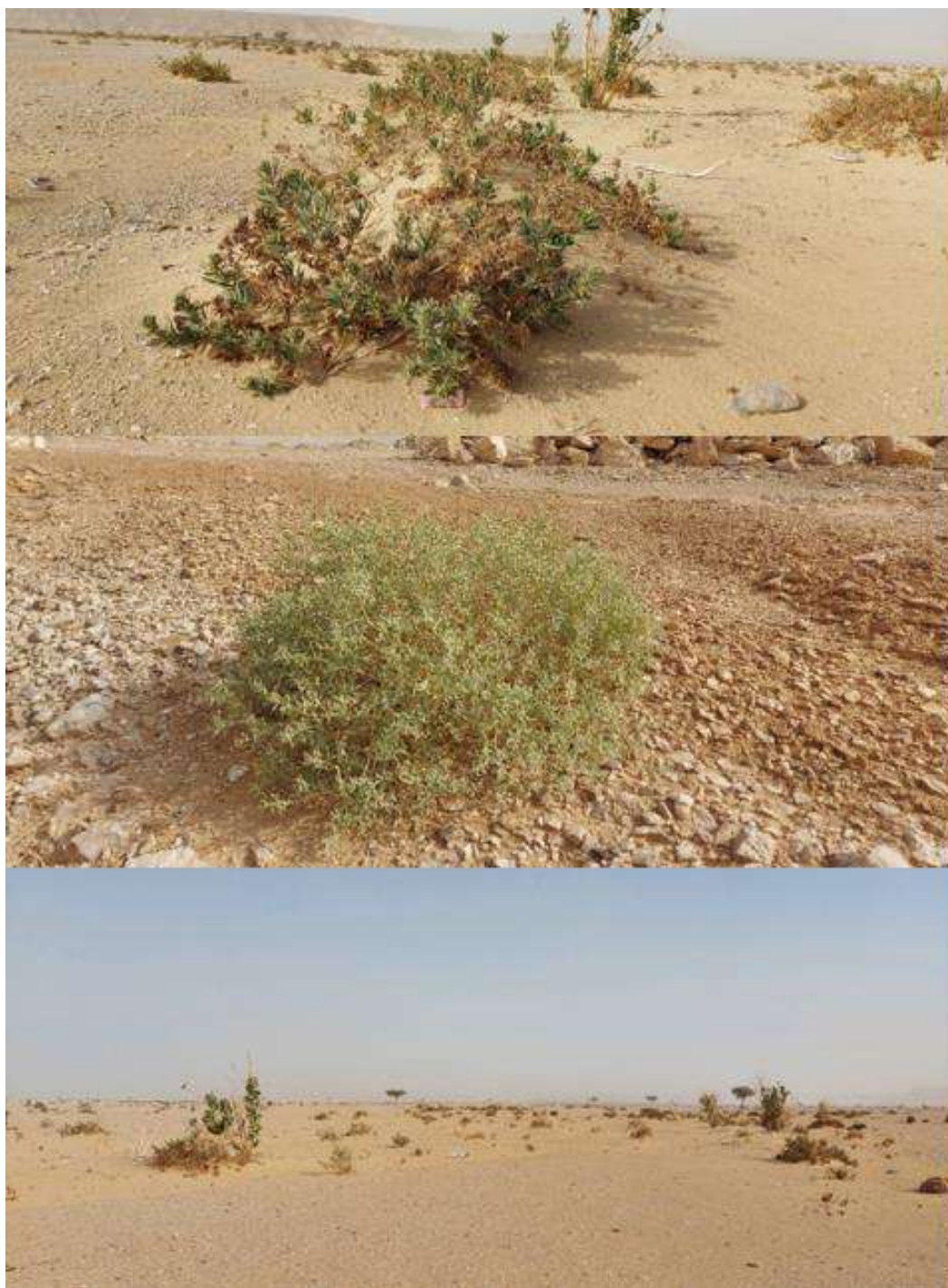


Figure 37 : Some of the perennial plant species recorded at the Project Site, from top to bottom: *Clusia lanceolata*, *Tetraena coccinea* and *Calotropis procera*.

5.4.5.1 Mammals and Reptiles

5.4.5.1.1 Desktop Review

A list was compiled for all reptile and mammal species that the Project Site is located inside their distribution range. For reptiles, in total, the Project Site is located inside the distribution range of 20 reptile species. One out of which is evaluated as globally threatened (Vulnerable) although no burrows of the species were noticed at the Project Site, see Table 40.

As for mammals, 12 species out of the 13 species are evaluated as Least Concern while a single species is recorded as Vulnerable; Arabian Sand Gazelle *Gazella marica*, see Table 41.

Table 43: Reptile Species that the Project Site overlaps with their Distribution Range

Class	Order	Family	Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)
Reptilia	Squamata	Lacertidae	Bosk's Fringe-toed Lizard	<i>Acanthodactylus boskianus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Lacertidae	-	<i>Acanthodactylus schmidtii</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Agamidae	Spotted Toad-headed Agama	<i>Phrynocephalus maculatus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Agamidae	Arabian Toad-headed Agama	<i>Phrynocephalus arabicus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Agamidae	Horny-scaled Agama	<i>Trapelus ruderatus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Agamidae	Egyptian Spiny-tailed Lizard	<i>Uromastyx aegyptia</i>	Extant (Resident)	Vulnerable
Reptilia	Squamata	Varanidae	Desert Monitor	<i>Varanus griseus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Gekkonidae	Middle Eastern Short-fingered Gecko	<i>Stenodactylus doriae</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Gekkonidae	Arabian Web-footed Sand Gecko	<i>Stenodactylus arabicus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Scincidae	Common Skink	<i>Scincus scincus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Psammophiidae	Hooded Malpolon	<i>Rhagerhis moilensis</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Psammophiidae	Afro-Asian Sand Snake	<i>Psammophis schokari</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Viperidae	Arabian Horned Viper	<i>Cerastes gasperettii</i>	Extant (Resident)	Least Concern

Class	Order	Family	Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)
Reptilia	Squamata	Viperidae	Palestine Saw-scaled Viper	<i>Echis coloratus</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Boidae	Arabian Sand Boa	<i>Eryx jayakari</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Leptotyphlopidae	Beaked Thread Snake	<i>Myriopholis macrorhyncha</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Trogonophidae	Zarudnyi's Worm Snake	<i>Diplometopon zarudnyi</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Colubridae	Common Leaf-nosed Snake	<i>Lytorhynchus diadema</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Colubridae	Braid Snake	<i>Platyceps rhodorachis</i>	Extant (Resident)	Least Concern
Reptilia	Squamata	Colubridae	Diadem Snake	<i>Spalerosophis diadema</i>	Extant (Resident)	Least Concern

Table 44: Mammal Species that could be present the Project Site

Class	Order	Family	Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)
Mammalia	Carnivora	Canidae	Red Fox	<i>Vulpes vulpes</i>	Extant (Resident)	Least Concern
Mammalia	Carnivora	Canidae	Rüppell's Fox	<i>Vulpes rueppellii</i>	Extant (Resident)	Least Concern
Mammalia	Carnivora	Canidae	Grey Wolf	<i>Canis lupus</i>	Extant (Resident)	Least Concern
Mammalia	Chiroptera	Vespertilionidae	Kuhls Pipistrelle	<i>Pipistrellus kuhlii</i>	Extant (Resident)	Least Concern
Mammalia	Chiroptera	Hipposideridae	Geoffroy's Trident Leaf-nosed Bat	<i>Asellia tridens</i>	Extant (Resident)	Least Concern
Mammalia	Eulipotyphla	Erinaceidae	Desert Hedgehog	<i>Paraechinus aethiopicus</i>	Extant (Resident)	Least Concern
Mammalia	Rodentia	Dipodidae	Lesser Egyptian Jerboa	<i>Jaculus jaculus</i>	Extant (Resident)	Least Concern
Mammalia	Rodentia	Muridae	Pygmy Gerbil	<i>Gerbillus benleyi</i>	Extant (Resident)	Least Concern
Mammalia	Rodentia	Muridae	Cheesman's Gerbil	<i>Gerbillus cheesmani</i>	Extant (Resident)	Least Concern
Mammalia	Rodentia	Muridae	Dwarf Gerbil	<i>Gerbillus nanus</i>	Extant (Resident)	Least Concern

Class	Order	Family	Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)
Mammalia	Rodentia	Muridae	Sundevall's Jird	<i>Meriones crassus</i>	Extant (Resident)	Least Concern
Mammalia	Rodentia	Muridae	Fat Sand Rat	<i>Psammomys obesus</i>	Extant (Resident)	Least Concern
Mammalia	Cetartiodactyl	Bovidae	Arabian Sand Gazelle	<i>Gazella marica</i>	Extant (Resident)	Vulnerable

5.4.5.1.2 Field Survey

No live mammals or reptiles and/or burrows were recorded throughout the survey. On the other hand, only Camels were encountered during the survey while no other livestock were encountered. Indications of intense levels of grazing were observed across the vegetation at the Project Site.

5.4.5.2 Areas of Conservation Importance

The Project Site does not overlap with any areas of nature conservation importance. The closest area to the Project Site is a Key Biodiversity Area called Hawtat Bani Tamim KBA, which is located around 90 Km north of the Project Site. The site was originally declared as an Important Bird Area (IBA) and does not trigger any of the global KBA criteria and therefore only triggers regional criteria. The site also contains the Ibex Reserve (Hawtat Bani Tamim) which is a nationally declared protected area that was established for the objective of conserving the Nubian *Ibex Capra nubiana*. The protected area is partially fenced, and grazing is controlled.

5.5 Birds

5.5.1 Desk Review

Based on the desktop review, the Project Site does not overlap with any Important Bird Areas (IBAs).

According to BirdLife International Sensitivity Mapping Tool for Migratory Soaring Birds (BirdLife, 2022), it shows that the Project Site does not potentially indicate a high level of migration. No satellite-tracked bird is documented to pass over the Project Site. Also, according to the Sensitivity Mapping Tool, only two species of Migratory Soaring Birds (MSBs) are considered to have their distribution range covering the Project Site; Lappet-faced Vulture *Torgos tracheliotos* and Griffon Vulture *Gyps fulvus*, see Figure 37.

Taking a more comprehensive review of the distribution range of all globally threatened species shows that additional four species of Migratory Soaring Birds have the Project Site overlapping with their distribution range, see Table 42. Additionally, ten more MSB species also have their distribution range overlapping with the Project Site, see Table 43. It should be noted, that although the distribution range of all these species overlap with the Project Site, it is not possible to estimate the numbers for each species that can be present at the Project Site.

One significant observation from this review is the indication that none of the species listed have their breeding distribution overlapping with the Project Site although the Project Site is located in an area that can be considered suitable for breeding raptors.



Figure 38: The results shown at BirdLife International Sensitivity Mapping Tool for Migratory Soaring Birds, showing the Project Site delineation with a 20km extensions area

Birds field survey was conducted in two different seasons fall and spring.

5.5.2 Birds field survey

5.5.2.1 Methodology of survey

Wind turbines are associated with impacts on birds from risks of collision and electrocution for both migratory soaring birds (which could pass over the site during the spring and autumn migration seasons) and resident soaring birds in the area. In order to determine the significance of an impact it is important to understand the sensitivity of the receiving environment and the magnitude of the impact both of which are discussed in further details below.

As demonstrated earlier, the Project Site does not seem to be located neither in a high-passage area for migratory soaring birds nor high-density range for resident and breeding species.

However, since the development of wind energy project could have a potential negative impact on the population of large-sized birds, such as MSBs, it is crucial to have a comprehensive understanding of the presence and movement of these species at the Project Site and its vicinity. Based on this, a comprehensive in-flight monitoring is proposed to be undertaken.

The methodology to be applied will follow the South African Birds and Wind-Energy Best-Practice Guidelines (Jenkins et al, 2015), the assessments will use specific pre-assigned vantage points (VPs) that will be used throughout the seasons in order to achieve the objectives of the monitoring for a period of two seasons, spring (March-May) and autumn (September-November).

The objective of the survey is to provide an assessment of the use of the migratory and resident soaring birds in the project site while providing a detailed analysis of the durations that these species use at the Project Site and the elevations at which they are present, which would eventually provide an in-depth understanding of the predicted impact of the project on bird species.

Building on the findings of the biodiversity assessment, all species identified in the desktop review will be targeted for monitoring throughout the monitoring seasons. All individuals encountered will have their movement information recorded, including the time every individual spends in the rotor-swept area, its behavior, direction while it is detailed route will be drawn on maps in order to be used in the Collision Risk Modelling.

Following a preliminary view-shed analysis, locations of vantage points were selected to cover the project areas as a whole. A total of 22 VPs were selected for monitoring in both seasons covering the Project Site, see Figure 38. Each vantage point will be covering a view of 360 degrees extending for a maximum radius distance of 2.5 Km.

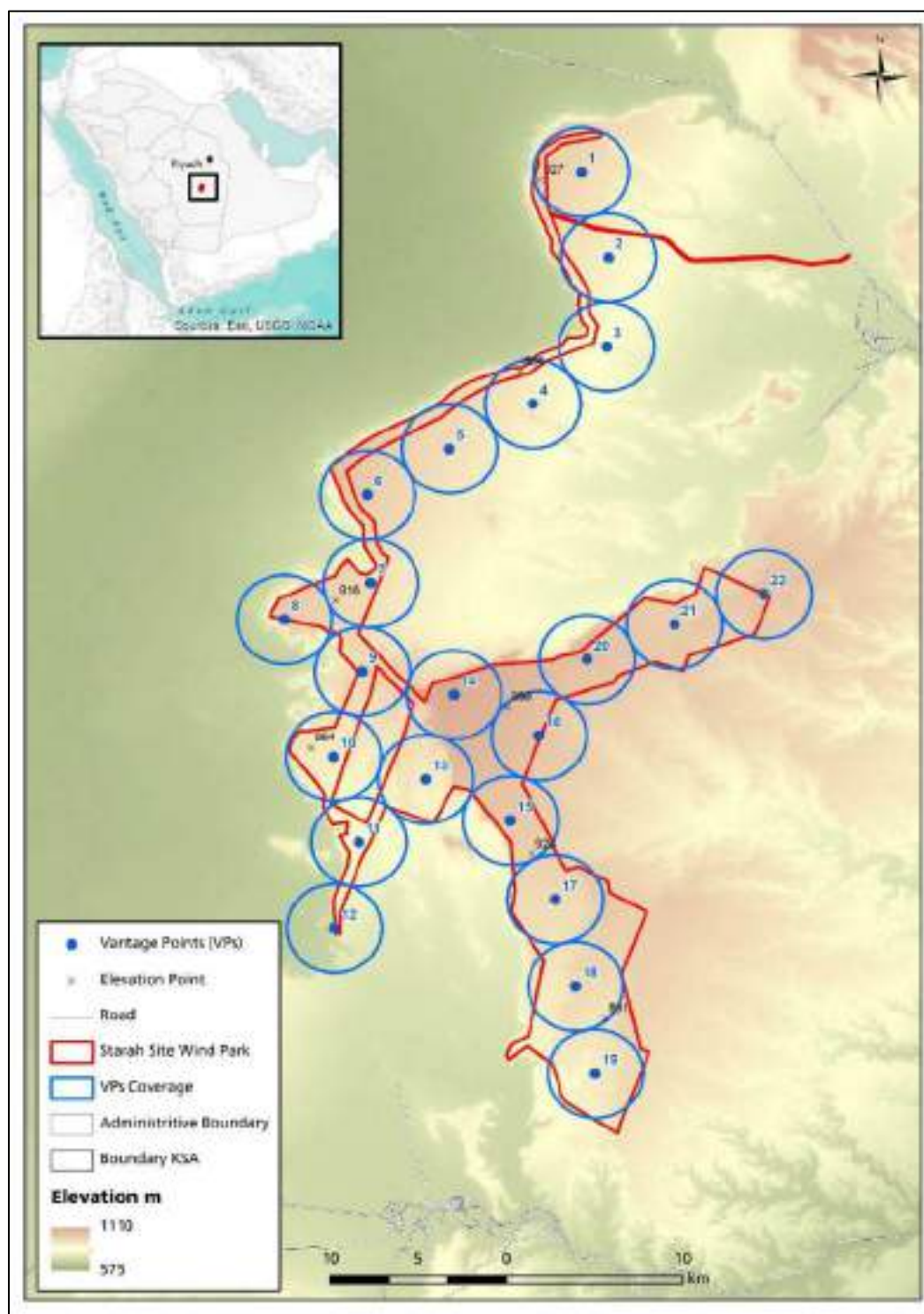


Figure 39 : Vantage Points (VPs) covering the Project Site

The coverage of the vantage points was divided over two time-strata during the day: morning and afternoon. Observation periods were for a maximum of four hours with a minimum of 30-minute break in between, in order to ensure that the quality of monitoring does not get affected by the observers' exhaustion. At the end of the observation session hours, the observer moved to another vantage point following a pre-set schedule. In total, the observer will cover two observation periods per day with a maximum of eight hours with each of the observation periods covering one of the time stratum mentioned earlier.

Each vantage point should be covered for a total of 48 hours during each season. Overall, the level of effort covering all 22 vantage points per season will be 1,056 hours of monitoring. Taking into consideration the duration of each season not exceeding 75-80 days and the minimum number of hours to be covered per day is 6 hours, it is estimated that a maximum of three qualified observers can undertake the whole monitoring for both seasons.

It is crucial that all VPs that are located along the escarpments, should monitor the bird activity in relation to roosting and possible breeding. Although, no solid proof of breeding raptors could be found during the field survey and based on the desktop study, the rock ledges and the escarpment seem to provide suitable spots for roosting for migratory soaring bird and also resident species, see Figure 39.



Figure 40: The escarpment along the western part of the Project Site showing potential resting and roosting areas for MSBs

5.5.2.2 Limitations

This is a preliminary survey and will be used as an indication for the avifaunal use of the Project Site and cannot in no way be used to provide general conclusions about the avifaunal activities at the Project Site for the whole migration seasons or the whole year.

As mentioned earlier, the number of VPs to be covered were twenty-two (22) over a slightly short period. this was not possible due to unavailability of accommodation and only eight (8) days of monitoring could be covered with a total of sixteen (16) VPs. The team has decided to omit the VPs that provided the least coverage of the project site. Also, due to the unavailability of accommodation close to the project site since the closest available accommodation was almost two hours away from the project site, it was decided to cover a minimum of three hours per VP instead of a maximum of four hours. Another factor that has played a major role in this decision was the difficult terrain across the project site which has made it very difficult to cover a total of eight hours of daylight monitoring and restricted the time available for monitoring to a minimum of six hours per day.

5.5.2.3 Survey results

5.5.2.3.1 Field Survey in autumn season

autumn survey was limited to observation of species passing across the site. During this survey only six species was observed incidentally. None of the species recorded are globally threatened or Migratory Soaring Birds, which are the most vulnerable species to wind energy development.

Table 45: Migratory Soaring Bird Species and Globally Threatened Species that the Project Site overlaps with their Distribution Range

Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Globally Threatened MSBs (Priority species)				
Griffon Vulture	<i>Cyps fulvus</i>	Extant (Resident)	Least Concern	Endangered
Lappet-faced Vulture	<i>Torgos tracheliotos</i>	Extant (Resident)	Endangered	Vulnerable
Steppe Eagle	<i>Aquila nipalensis</i>	Extant (Non-breeding)	Endangered	Not Applicable
Eastern Imperial Eagle	<i>Aquila heliaca</i>	Extant (Non-breeding)	Vulnerable	Not Applicable
Greater Spotted Eagle	<i>Clanga clanga</i>	Extant (non-breeding / passage)	Vulnerable	Not Applicable
Saker Falcon	<i>Falco cherrug</i>	Extant (passage)	Endangered	Critically Endangered
Osprey	<i>Pandion haliaetus</i>	Extant (non-breeding)	Least Concern	Least Concern
Short-toed Snake-Eagle	<i>Circaetus gallicus</i>	Extant (non-breeding)	Least Concern	Vulnerable
Booted Eagle	<i>Hieraaetus pennatus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Black Kite	<i>Milvus migrans</i>	Extant (non-breeding)	Least Concern	Not Applicable
Montagu's Harrier	<i>Circus pygargus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Pallid Harrier	<i>Circus macrourus</i>	Extant (non-breeding)	Near Threatened	Not Applicable
Peregrine Falcon	<i>Falco peregrinus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Common Kestrel	<i>Falco tinnunculus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Lesser Kestrel	<i>Falco naumanni</i>	Extant (non-breeding)	Least Concern	Not Applicable

Table 46: Avifauna Species Recorded on Site

Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Eurasian Collared dove	<i>Streptopelia decaocto</i>	Extant (Resident)	Least Concern	Least Concern
Brown-necked Raven	<i>Corvus ruficollis</i>	Extant (Resident)	Least Concern	Least Concern
Eurasian Hoopoe	<i>Upupa epops</i>	Extant (Resident)	Least Concern	Least Concern
Barn Swallow	<i>Hirundo rustica</i>	Extant (passage)	Least Concern	Least Concern
Pale Rock Martin	<i>Ptyonoprogne obsoleta</i>	Extant (Resident)	Least Concern	Least Concern
Hooded Wheatear	<i>Oenanthe monacha</i>	Extant (Resident)	Least Concern	Least Concern

5.5.2.3.2 Survey of spring season

5.5.2.3.2.1 Targeted species

This survey was an In-Flight Monitoring During Migration Season. The main species targeted by this survey are given in the table 44 below

Table 47: List of target species during the survey

Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Globally Threatened MSBs (Priority species)				
Griffon Vulture	<i>Gyps fulvus</i>	Extant (Resident)	Least Concern	Endangered
Lappet-faced Vulture	<i>Torgos tracheliotos</i>	Extant (Resident)	Endangered	Vulnerable
Steppe Eagle	<i>Aquila nipalensis</i>	Extant (Non-breeding)	Endangered	Not Applicable
Eastern Imperial Eagle	<i>Aquila heliaca</i>	Extant (Non-breeding)	Vulnerable	Not Applicable
Greater	<i>Clanga</i>	Extant (non-breeding /	Vulnerable	Not Applicable

Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Spotted Eagle	<i>clanga</i>	passage)		
Saker Falcon	<i>Falco cherrug</i>	Extant (passage)	Endangered	Critically Endangered
Other MSBs (Least Concern and Near Threatened)				
Osprey	<i>Pandion haliaetus</i>	Extant (non-breeding)	Least Concern	Least Concern
Short-toed Snake-Eagle	<i>Circaetus gallicus</i>	Extant (non-breeding)	Least Concern	Vulnerable
Booted Eagle	<i>Hieraaetus pennatus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Black Kite	<i>Milvus migrans</i>	Extant (non-breeding)	Least Concern	Not Applicable
Montagu's Harrier	<i>Circus pygargus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Pallid Harrier	<i>Circus macrourus</i>	Extant (non-breeding)	Near Threatened	Not Applicable
Globally Threatened MSBs (Priority species)				
Peregrine Falcon	<i>Falco peregrinus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Common Kestrel	<i>Falco tinnunculus</i>	Extant (non-breeding)	Least Concern	Not Applicable
Lesser Kestrel	<i>Falco naumanni</i>	Extant (non-breeding)	Least Concern	Not Applicable

5.5.2.3.2.2 Results

Three target species were recorded during the survey in addition to a single unidentified falcon, see Table 45. Egyptian Vulture *Neophron percnopterus* was the only species recorded that is globally threatened (Endangered). It is also evaluated as Vulnerable on the regional level of the Arabian Peninsula.

Table 48: List of target species recorded during the survey

Common Name	Scientific Name	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Egyptian Vulture	<i>Neophron percnopterus</i>	Extant (passage)	Endangered	Vulnerable
Steppe Buzzard	<i>Buteo buteo vulpinus</i>	Extant (passage)	Least Concern	Not Applicable
Common Kestrel	<i>Falco tinnunculus</i>	Extant (resident)	Least Concern	Least Concern
Falcon species	<i>Falco sp.</i>	Not Applicable	Not Applicable	Not Applicable

All records of all target species were records of single individuals flying over the survey area in single flights except for the Egyptian Vulture flight which was of two individuals. Common Kestrel *Falco tinnunculus* was the only species recorded at more than one occasion with three records of single birds. In total, 83.3 % of the flights of target species recorded during the survey were recorded at collision risk height, Table 46.

Table 49: Number of flights and individuals of target species during the survey and percentage of flights at risk height

Common Name	Scientific Name	Number of flights	Number of individuals	Percentage of flights at risk height	Flight time spent at risk height (seconds)
Egyptian Vulture	<i>Neophron percnopterus</i>	1	2	100	60
Steppe Buzzard	<i>Buteo buteo vulpinus</i>	1	1	0	10
Common Kestrel	<i>Falco tinnunculus</i>	3	3	66.7	75
Falcon species	<i>Falco sp.</i>	1	1	100	30
Total	6	6	7	83.3	175

Temporally, the six flights of the target species were recorded in five days of monitoring with the survey on the 24th of April at VP 15 being the only survey that included two flight records of target species while three days of monitoring did not include any flight records for target species, see Table 47.

Table 50: Temporal distribution of flight records of target species

Common Name	Scientific Name	Photos of species	Number of flights	Number of individuals	Date
Egyptian Vulture	<i>Neophron percnopterus</i>		1	2	22/04/2022
Steppe Buzzard	<i>Buteo buteo vulpinus</i>		1	1	24/04/2022
Common Kestrel	<i>Falco tinnunculus</i>		3	3	24, 26 & 28/04/2022
Falcon species	<i>Falco sp. (example)</i>		1	1	27/04/2022

Over the hours of daylight, three out of the six flight records were recorded in the early hours of monitoring and specifically between 07:00 and 08:00 in the morning while the other three flight records were distributed across the day with two of the flight records being in the early afternoon hours between 13:00 and 14:00, see Figure 40.

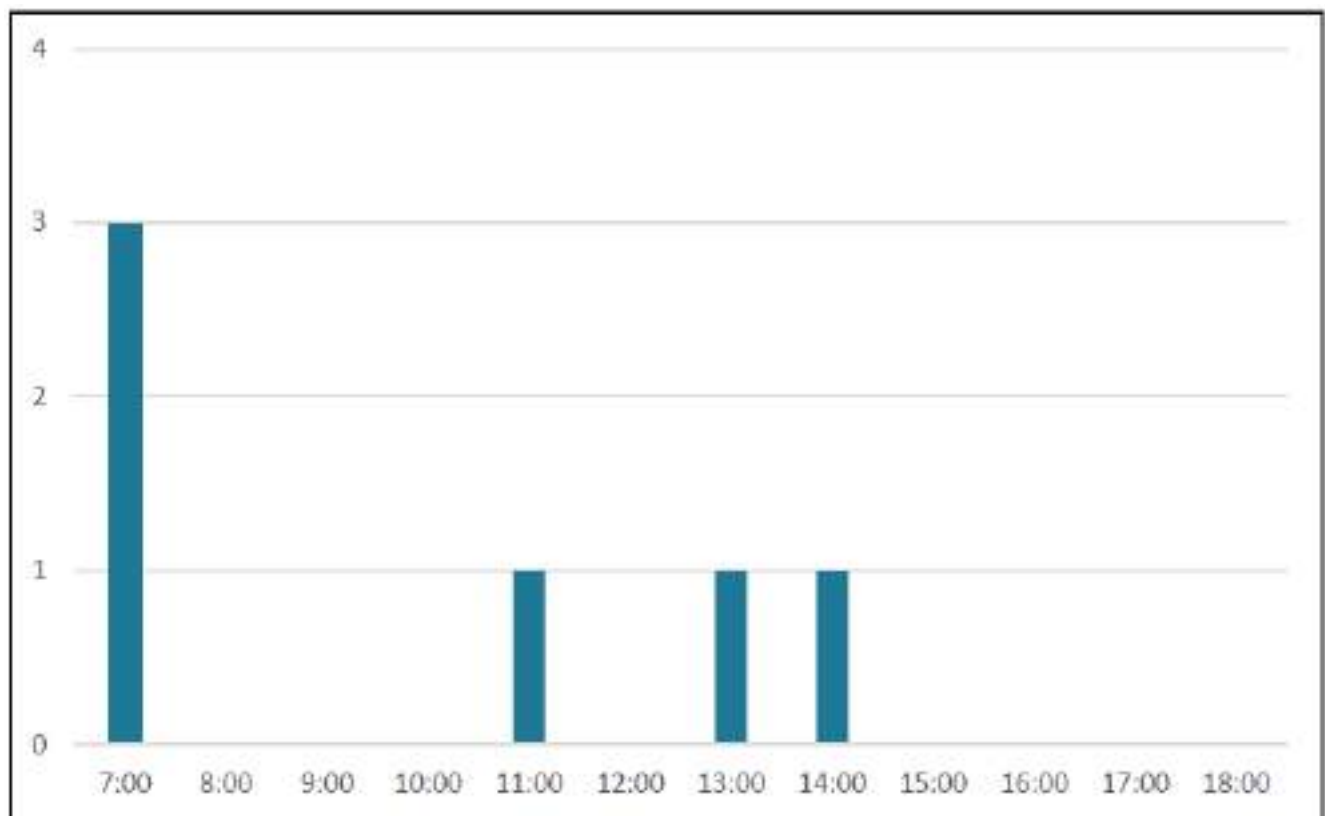


Figure 41: Number of flight records over daylight hours

Spatially, the six flight records were recorded at five different VPs with VP15 being the only VP that had two records. Three of the VPs with flight records were located in the northern part of the project site; VPs 3, 4 and 5 while the remaining two VPs were located in the central part; VPs 14 and 15.

In addition to the target species, twenty-one (21) other species were recorded during the survey with the majority being passerine resident species. None of those species are globally or regionally threatened, Table 48.

Table 51: List of non-target species recorded during the survey

Common Name	Scientific Name	Photo of species	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Rock Dove	<i>Columba livia</i>		Extant (Resident)	Least Concern	Least Concern
Common Swift	<i>Apus apus</i>		Extant (passage)	Least Concern	Not Applicable
Arabian Green Bee-eater	<i>Merops cyanophrys</i>		Extant (Resident)	Least Concern	Least Concern

Common Name	Scientific Name	Photo of species	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Western Yellow Wagtail	<i>Motacilla flava</i>		Extant (passage)	Least Concern	Not Applicable
Barn Swallow	<i>Hirundo rustica</i>		Extant (Passage)	Least Concern	Least Concern
Northern House Martin	<i>Delichon urbica</i>		Extant (Passage)	Least Concern	Least Concern

Common Name	Scientific Name	Photo of species	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Desert Lark	<i>Ammomanes desert</i>		Extant (Resident)	Least Concern	Least Concern
Crested Lark	<i>Galerida cristata</i>		Extant (Resident)	Least Concern	Least Concern
Northern Wheatear	<i>Oenanthe oenanthe</i>		Extant (Passage)	Least Concern	Least Concern

Common Name	Scientific Name	Photo of species	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Isabelline Wheatear	<i>Oenanthe isabellina</i>		Extant (Resident)	Least Concern	Least Concern
Pied Wheatear	<i>Oenanthe pleschanka</i>		Extant (Resident)	Least Concern	Least Concern
Desert Wheatear	<i>Oenanthe deserti</i>		Extant (Resident)	Least Concern	Least Concern

Common Name	Scientific Name	Photo of species	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Lesser Grey Shrike	<i>Lanius minor</i>		Extant (Passage)	Least Concern	Least Concern
Woodchat Shrike	<i>Lanius senator</i>		Extant (Passage)	Least Concern	Least Concern
Masked Shrike	<i>Lanius nubicus</i>		Extant (Resident)	Least Concern	Least Concern

Common Name	Scientific Name	Photo of species	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Brown-necked Raven	<i>Corvus ruficollis</i>		Extant (Resident)	Least Concern	Least Concern
Hooded Crow	<i>Corvus corone cornix</i>		Extant (Resident)	Least Concern	Least Concern
Common Chiffchaff	<i>Phylloscopus collybita</i>		Extant (passage)	Least Concern	Not Applicable

Common Name	Scientific Name	Photo of species	Distribution Status	IUCN Threatened Species Status (2022)	IUCN Red List Status for Breeding Birds of Arabia (2015)
Willow Warbler	<i>Phylloscopus trochilus</i>		Extant (passage)	Least Concern	Not Applicable
Wood Warbler	<i>Phylloscopus sibilatrix</i>		Extant (passage)	Least Concern	Not Applicable
House Sparrow	<i>Passer domesticus</i>		Extant (Resident)	Least Concern	Least Concern

5.5.2.3.2.3 Observations and recommendations

As highlighted earlier, an avifaunal in-flight monitoring survey for a total of eight days during a single spring migration is a very small and non-representative sample of monitoring for migration monitoring. It is strongly advised not to build solid conclusions out of this survey. As has been clarified earlier, the results of this preliminary survey can be considered as indicative. The observations from the survey can be summarized in the following:

- The number of target species and their flights across the survey period is considered to be extremely low. No flocks of migratory species were recorded throughout the survey and only a single flight included more than a single bird.
- The recording of the globally threatened Egyptian Vulture *Neophron percnopterus* is worth noting, with two individuals passing over the site in a single flight. This could be an indication that the species passes over the project site regularly during migration.
- No large-sized resident raptor species were recorded during the survey. Species such as Long-legged Buzzard *Buteo rufinus* were expected to be recorded. This could be an indication that the species does not breed in the project site and its vicinity.
- Based on the above and in order to a better understanding of the activity of large-sized birds in the project site and its vicinity, it is highly recommended to carry out a comprehensive seasonal in-flight monitoring covering all VPs of the project site for at least two seasons; autumn and spring. The surveys should follow the international standards and would lead to further in-depth analysis and collision risk-modelling which would provide a better understanding of the activity of the target species at the project site.

5.6 Bats

Based on the desktop review and the field survey, the Project Site does not seem to have large numbers of species and does not seem to have suitable areas for roosting and feeding in the vicinity of the Project Site. However, since the impact of wind farm development on volant mammals is well documented, it is recommended to undertake a preliminary survey to search for potential roosting sites at the Project Site and its surroundings and undertake a transect survey using handheld bat detectors at different locations at the Project Site in the period from March to August since it is the period of high activity of bats.

5.7 Socio-economic Environment

5.7.1 Geography and location of Riyadh region

Located in the geographic centre of the country, the Riyadh Region has an area of 404,240 km² and a population of 6,777,146 (2010), making it the second largest region in terms of both area (after the Eastern Region), and population (after Makkah Region). The region shares its borders with seven other administrative regions of the Kingdom, namely the Eastern Region in the East, Al Qassim Region in the North, Asir, Makkah, and Madinah in the West, and Najran in the South.

The Riyadh Region is characterized by a desert climate, dry and hot in the summer, and cold in the winter with low rainfall. The average temperature in Riyadh is 25°C, rising in the summer to more than 50°C and dropping in the winter to 0°C, with a humidity of 33.1% and an annual rainfall of 84.4 mm. The area is also exposed to recurrent sandstorms being surrounded by desert sand dunes.

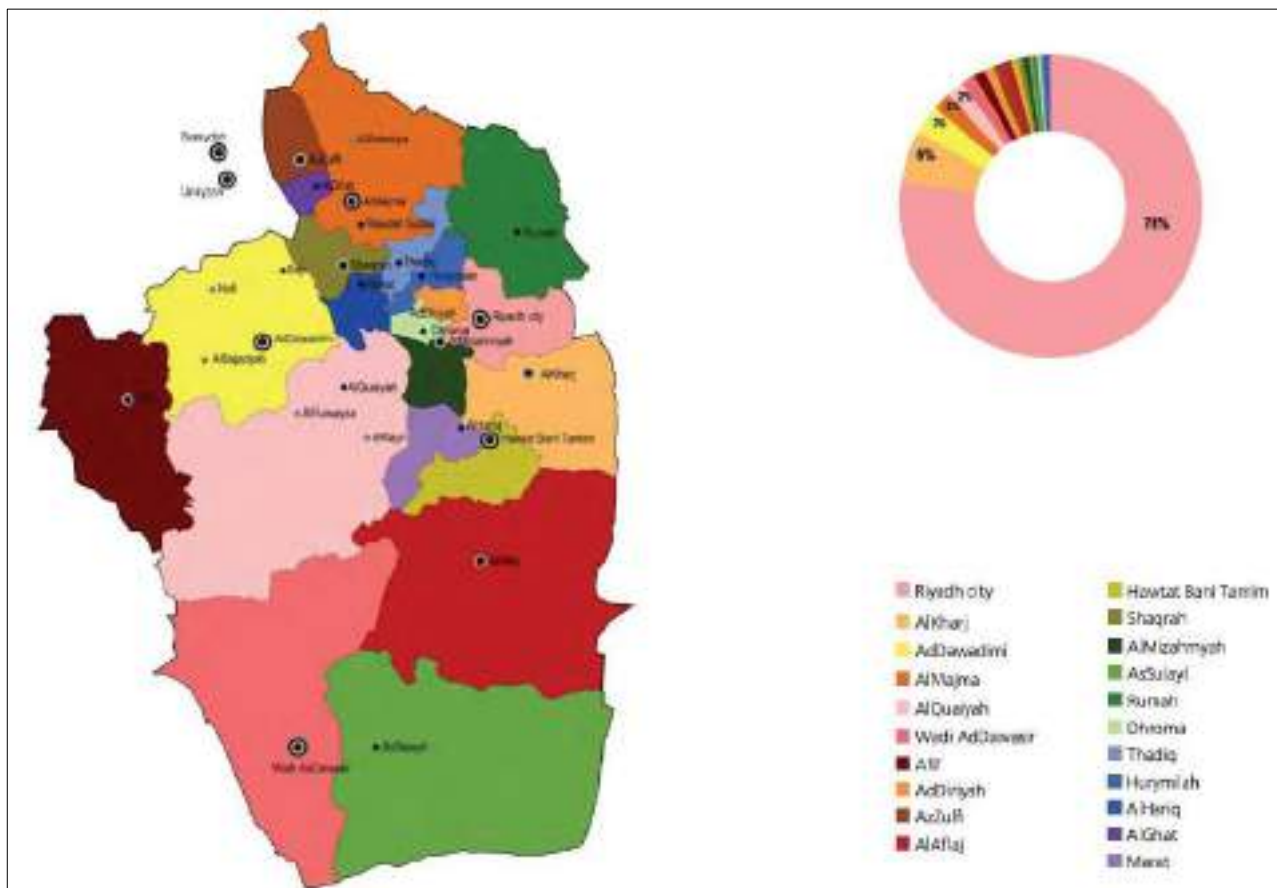


Figure 42 : Administrative boundaries of Riyadh region

5.7.2 Demographic background of Riyadh region

More than 75% of the population of the region resides within Riyadh. According to the 2004 Census, 1,728,840 of the region’s population was non-Saudi (approximately 31%), with 1,444,500 of those living within the provincial capital, Riyadh.

According to the 2010 census, the city of Riyadh had 5.2 million inhabitants, while the Riyadh Household Survey 2016, conducted by the Arriyadh Development Authority (ADA), recorded the population at 6.5 million in 2016. Riyadh is the largest and one of the fastest growing cities in the Kingdom of Saudi Arabia with an annual growth rate of 4%, higher than the national average estimated at 2.11%. The average household size in Riyadh is projected at 5.7 people per household, down from around 6.6 in the 2010 census. The population density of the city of Riyadh has increased to about 4,659 p/ha, an increase from 4,000 p/ha in 2010. According to the 2010 census data, the population comprised of 56% male and 44% female, whereas non-Saudi males represent 63% compared to 37% females, in line with the national trend.

The distribution of non-Saudis with respect to age and gender is explained by the fact that majority of them are in the country to work, mostly without their spouses. Riyadh City has a young population, with people below 24 years of age constituting 46% of the total city population, while a population of 60 years and above constitutes 4.19%. The average life expectancy in Riyadh is 72 years. The population pyramid for Saudis shows a wide base and gets narrower as you go upwards, which indicates an overpowering number of youths. Additionally, the under-15’s alone make up 30% of Saudis and 19.7% for non-Saudis

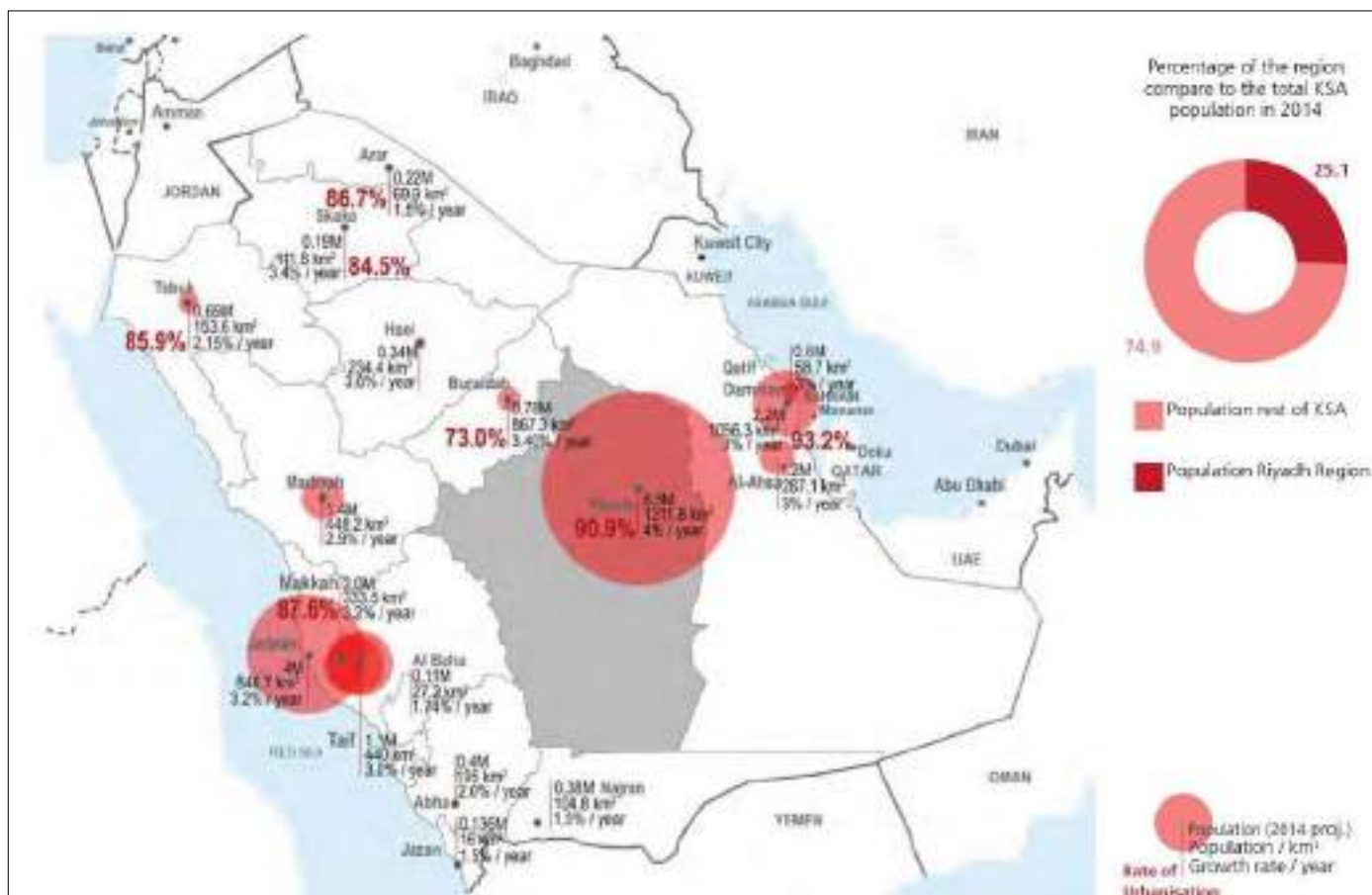


Figure 43 : population Riyadh region

5.7.3 Transport infrastructure of Riyadh region

5.7.3.1 Internal roads network of Riyadh

The Riyadh Region enjoys a modern and developed network of highways and bridges, linking the major cities to the industrial, commercial and agricultural facilities and connecting Riyadh to the neighbouring regions. The region is currently witnessing new projects and expansions in its internal road network, as well as the roads linking the region with other areas. According to our analysis, the percentage of people living within a 60-minute drive from the major urban centres in the region amounts to 66.7% of the total population.

5.7.3.2 Railways Transport

The Riyadh Region is linked to the Eastern Region by a passenger railway line, which connects the city of Riyadh to Dhahran, Baqiq, Al Hofuf, and Dammam. The length of this rail line is 449 kilometres.

There is also another 556 km of railroad dedicated to cargo transportation, starting from King Abdulaziz Port in Dammam and terminating in Riyadh, passing through Abqiy, Al Hofuf, Hardh, and Kharj. The North-South line starting from Riyadh City extends to the North-West side towards Al Haditha city, adjacent to the Jordanian borders and passing through Qassim, Hail, and Al- Jouf Regions, and is now partially operational. So far, the portion from Riyadh-Qassim-Hail is operational. Six stations on the North- South train project have been allocated for passenger transport in Riyadh, in addition to the stations of Al Majmaah, Al Qassim, Hael, Al Jouf, and Al Hadithah. New lines of railway are also being implemented in the Kingdom, the most important of which is the Land Bridge, (East / West line), connecting the Riyadh Region with the Holy City of Makkah.

5.7.3.3 Air Transport

There are three airports in the Riyadh Region, including an international airport, King Khaled International Airport in Riyadh, and two regional airports: King Salman Airport in Dawadmi, and Wadi Al Dawasir Airport. The number of passengers using the airports of the Riyadh Region aboard internal flights made up 31% of the total air traffic in the Kingdom in 2012. King Khaled International Airport is considered one of the most advanced airports in the Middle East and one of the fundamental and important pillars on which the region depends for the growth of transport movement and air freight.

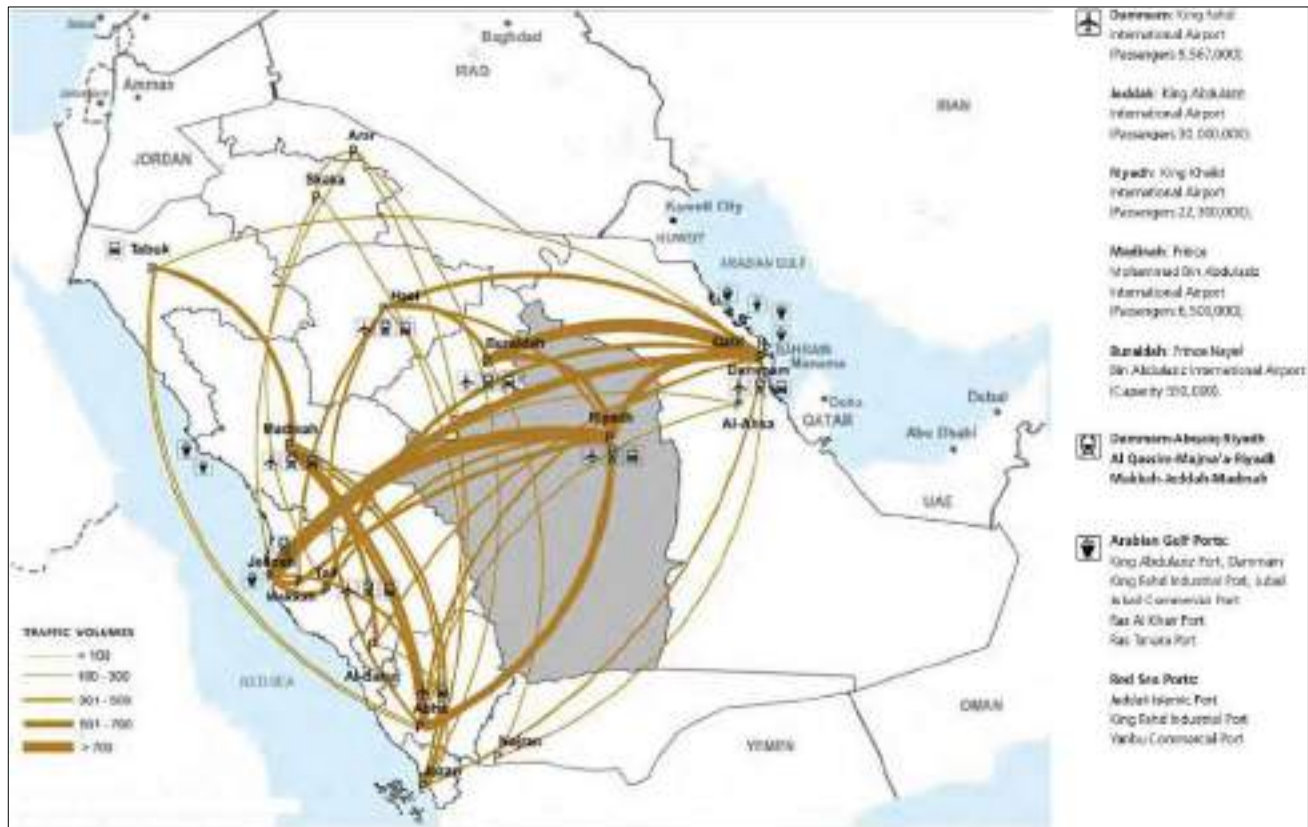


Figure 44: Transport connectivity between Saudi cities

5.7.4 Economy of Riyadh Region

The economy of Saudi Arabia and the revenues of its government are mainly dependent on oil and gas. This applies to the Riyadh Region and its administration, although most petroleum liquids are produced in the Eastern Region of the country. Considering the limited amount of oil and natural gas, and because of their non renewability, it is crucial for the country and Riyadh Region to prepare for the time beyond petroleum.

5.7.4.1 Gross Domestic Product

The Gross Domestic Product (GDP) in 2012 of the Riyadh Region amounted to about SR 417 billion, representing 15.3% of the GDP of the Kingdom and 29.2% of the GDP of the Kingdom without crude oil and gas. The average annual growth rate of the GDP of the region was about 12% during the period 2009-2012. Real estate and financial services sector ranks first in terms of contribution to the output of the Riyadh Region, with 25.7% contribution, followed by the trade sector with 15.4%, transport, storage and communications sector with 7.8%, construction and

building sector with 6.6%, industrial sector with 6.2%, and agricultural sector with 4.2% contribution.

5.7.4.2 Economic resources

Economic indicators for the Riyadh Region are summarised by the High Commission for the Development of Riyadh (HCDR 2012) which shows that metropolitan Riyadh captures around 84.2% of the GDP of the Riyadh Region, and the GDP per capita in metropolitan Riyadh is around SR 31,000, while in the governorates of Riyadh it is at approximately half this amount.

The city of Riyadh depends on the import of all kinds of products and services from its surrounding areas. Municipalities and rural areas in the Riyadh Region are strongly dependent on the development of the capital city. In return, the proximity to Riyadh provides access to economic opportunities and many public utilities in the health, education and other sectors.

Financial and banking services is one of the largest economic sectors and the most influential on the structuring of economic growth in Riyadh Region, given the services it provides to the private sector and the investment opportunities it offers for projects and enterprises, through the large number of banks and branches as well as the insurance companies and their branches, operating in Riyadh. The trade sector in Riyadh Region is also an important sector, because of the high volume of the companies and establishments represented and operating in the sector. The total number of enterprises and businesses in the Riyadh Region in 2012 amounted to about 30% of the total trade establishments in the Kingdom.

The building and construction sector in the Riyadh Region is another major economic sector in view of the vital role it plays in the economic growth; and also as a driver for physical development for the region itself. In Riyadh, a large number of major Saudi, joint, and foreign contracting companies operate in the implementation of these projects and contribute to the completion of infrastructure facilities. The total number of classified contractors in Riyadh Region in 2012 amounted to 44% of the total number of classified contractors in the Kingdom. The construction and building sector in Riyadh accounts for about 23.9% of the total volume of this sector in the Kingdom as a whole. Manufacturing industries sector is one of the important productive sectors in the Riyadh Region. The Riyadh Region has seven industrial cities, affiliated to the Saudi Industrial Property Authority (MODON). Two of these industrial areas in Riyadh are fully functional with services and facilities, while the other five industrial cities are still under development. The total number of producing factories in Riyadh Region were about 44.3% of the total number of producing factories in the Kingdom by the end of 2013. Agriculture is an important economic sector in the Riyadh Region, with a total crop area amounting to about 247,000 hectares, representing approximately 31% of the total crop area in the Kingdom in 2011.

development into a balanced and sustainable development process. The map in Figure 45 marks the different protected areas, priority areas, and sensitive areas. Comprehensive and sensitive regional planning practices offer an opportunity to better coordinate related developments, and to make the most effective and sustainable use of existing strengths and opportunities.

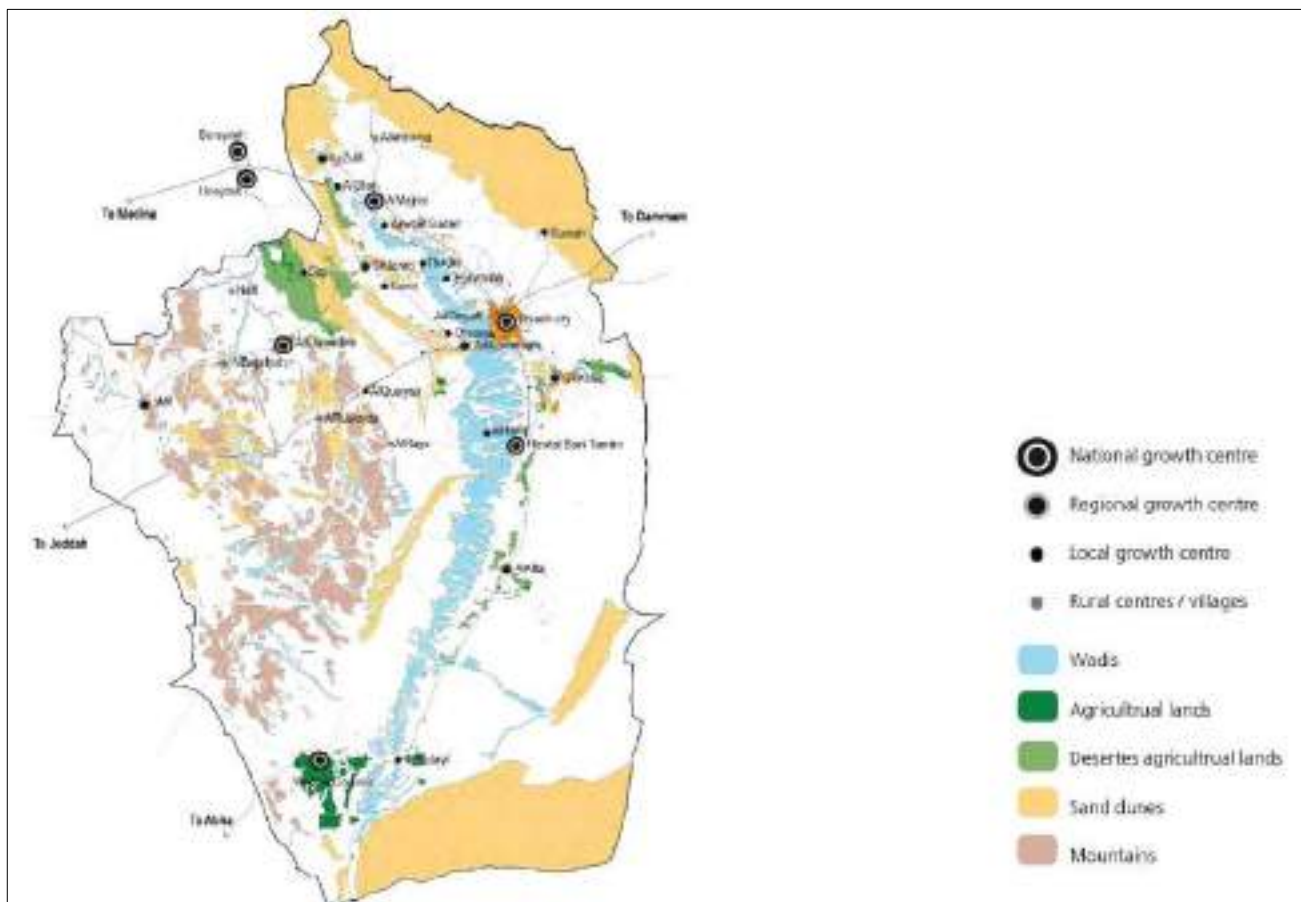


Figure 46: Natural resources in Riyadh region

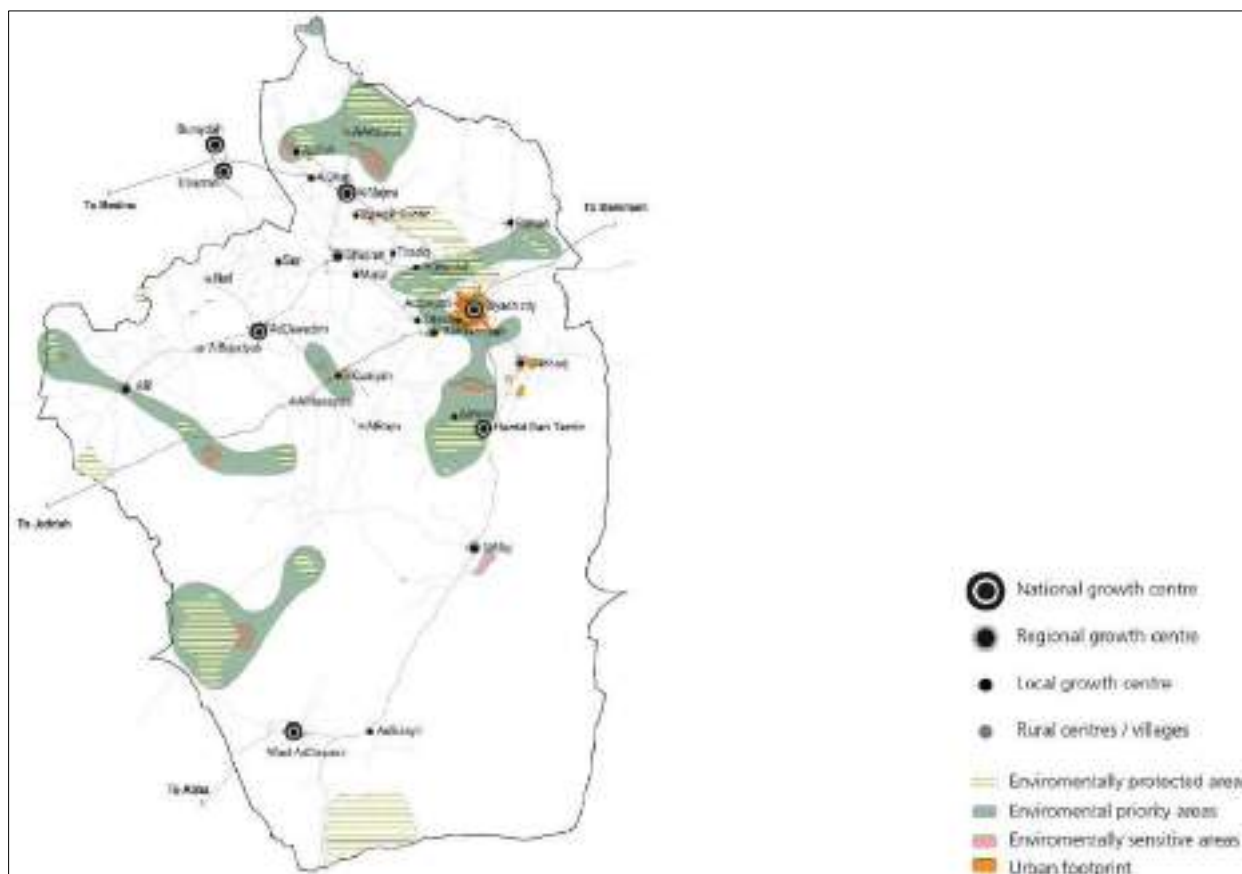


Figure 47: Environmentally protected areas in Riyadh region

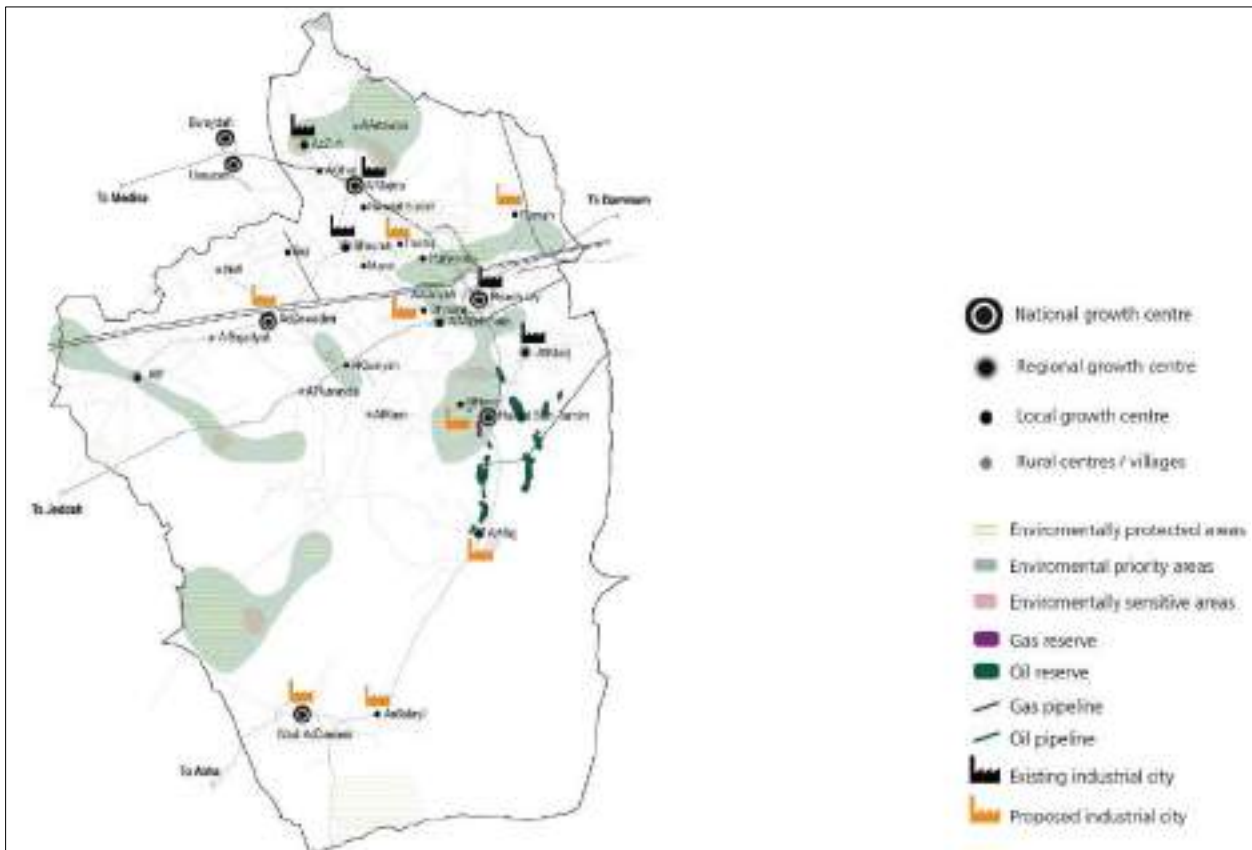


Figure 48: Oil and gas reserves, industrial cities and environmentally sensitive areas in Riyadh region

5.9 Sensitive receptors

5.9.1 Environment sensitive receptors

Sensitive areas are defined as the areas located near the Project and where occupants are more susceptible to the exposure of pollutants, chemicals, traffic, noise, and vibration as a result of the project construction and operation. Sensitive receptors include schools, universities, hospitals, housings, mosques, libraries, parks, Government buildings, cemeteries, museum, investigation centres, etc.

No sensitive receptors such mentioned above was identified within the project site except some seasonal shepherds/herders and temporary settlements whom main activity is grazing.

The nearest city which is al-Amar is far from the site boundaries almost 3 km

5.9.2 Ecological sensitive receptors

The Project Site is located on a flat sandy plain partially covered in gravel. The landscape is natural and does not feature any prominent human interventions.

During the ecology survey vegetation cover was evaluated as limited to groups of perennial shrubs/trees. Some parts of the Project Site are completely devoid of any vegetation cover while in others, sparse vegetation was observed.

The project site itself is evaluated to have a minor ecological value. no ecological sensitive receptor was identified close to the project site.

5.9.3 Socioeconomic sensitive receptors

Potential receptors relevant to the Socio-Economic impact assessment include:

- Farmers, seasonal herders, and recreational users within the site boundary and which utilize the wider landscape. The sensitivity of these receptors is valued as moderate on account their transient nature or limited likelihood of being occupied by vulnerable groups for extended periods.
- Local communities including settlements adjacent to the development site and along the route of potential transportation routes. The sensitivity of these receptors is valued as moderate and working age members of the community most likely to be affected and settlements on transport routes will not be receptors of impacts for extended periods.
- Local utility infrastructure and providers. The sensitivity of these receptors is valued as low on account of the ability to adapt and respond to change

6. IMPACT ASSESSMENT

6.1 Introduction

This section assesses the manner in which the Project will interact with elements of the physical, ecological or social environment to produce impacts to resources/ receptors. It has been organized as per the operational and decommissioning phases of the project life cycle to understand the risks and impacts associated with each phase.

6.2 Impact assessment methodological approach

The methodological approach used for the assessment of the potential environmental and socio-economic impacts associated with the construction and operation of the proposed Project and associated facilities and indicates how the relevant mitigation measures to be adopted for avoiding, reducing or compensating such impacts will be considered as part of the impact assessment process.

Impact identification and assessment starts with scoping. Once identified, potential impacts need to be assessed in order to enable a judgement of their significance that allows for the prioritization of the mitigation/enhancement and management measures. Potential Project impacts are assessed in relation to environmental and biological resources as well as socio-economic resources (community, individuals, and social, economic, and cultural assets) within the Project Area of Influence (AoI).

The principal ESIA steps comprise the following:

- **Impact prediction:** to determine what could potentially happen to resources or receptors because of the Project and its associated activities – potential impacts are identified during the ESIA scoping phase.
- **Impact evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource or receptor.
- **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of identified mitigation and enhancement measures.

6.3 Project area of Influence (AOI)

According to the IFC Performance Standard 1 “where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and

social risks and impacts will be identified in the context of the project's area of influence (AoI)", which is defined as to encompass the following (IFC, 2012):

- The area likely to be affected by: (i) the project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.
- Associated facilities, which are facilities 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.
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly affected by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

The Project AOI consists of the environmental and social aspects within the Project Site, if they exist and receptors within the 500m corridor along the project access roads and Electrical Transfer lines that will potentially be affected by the Project activities and operations and cumulative impacts of nearby other existing plants/facilities.

6.4 Identification and characterization of impacts

An 'impact' is any change to a resource or receptor caused by the presence of a project component or by a project- related activity. Impacts can be negative or positive and are defined in terms of their characteristics, including the impact's type (direct, indirect, induced, cumulative) and the impact's spatial and temporal features (i.e. extent, duration, scale and frequency).

Types of impacts are described as below:

- **Direct:** applies to an impact which can be clearly and directly attributed to a particular environmental or social parameter (e.g. dust generation directly affects air quality).
- **Indirect:** applies to impacts which may be associated with or subsequent to a particular impact on a certain environmental or social parameter (e.g. high levels of dust could entail nuisance and health effects to workers on site).
- **Induced:** applies to impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.

- **Cumulative:** applies to impacts that arise as a result of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect.

Impact characteristics are defined in the below table.

Table 52 : Impact Characterization Criteria

Duration	Short-term: impacts with relatively short duration with respect to the whole duration of the project (e.g. limited to five-year period).	Long-term: impacts whose effects last longer than a period of five years, but limited to within the project lifetime.	Permanent: impacts that cause a permanent change in the baseline conditions and therefore also evaluated as irreversible
Extent	Local: impact affecting the environment or communities within the Project AoI.	Regional: impact affecting a wider area or socio- economic asset of importance going beyond the communities in the Project Area of Influence.	National: impact extending to the national level, or affecting assets of national importance.
Frequency	One-off/ Occasional: impacts that occur once only or occasionally.	Intermittent: impacts that occur periodically or repeatedly.	Continuous: impacts that happen continuously
Intensity/Impact scale	Low: limited impacts not causing any change or causing change hardly distinguishable from background conditions	Medium: impacts causing change, but not affecting the core structures/functions of the resource/receptor	High: impacts causing evident changes of core structures/functions of the resource/receptor
Likelihood	Unlikely: The event is unlikely but may occur at some time during normal operating conditions	Possible: The event is likely to occur at some time during normal operating conditions.	Likely: The event will occur during normal operating conditions (i.e. it is essentially inevitable).

6.5 Evaluation of Impacts

A consistent approach to the assessment of impacts will be followed to enable environmental and social (E&S) impacts to be broadly compared across the ESIA. A set of generic criteria are used to determine impact significance and are applied across the various environmental and social parameters.

Environmental and social impacts are quantified as much as possible. For cases where quantification is not possible/applicable, a qualitative assessment is conducted using professional judgement, experience and available knowledge, and including the consideration of stakeholder views. Where there are limitations to the data, and/or uncertainties, these are recorded in the relevant sections, along with any assumptions made during the assessment.

In order to determine the significance of each impact, two overall factors are considered:

- Magnitude and nature of impacts
- The importance and/or sensitivity of the environmental and social receiving parameter, as determined during the assessment of baseline conditions.

6.5.1 Magnitude of Impact

Once impacts are characterized as per table, they are assigned a 'magnitude' which is typically a function of some combination (depending on the subject receptor) of the following characteristics:

- Duration
- Extent
- Frequency
- Scale.

Magnitude is a continuum from small to large, along which evaluation requires professional judgement and experience. Each impact is evaluated on a case-by-case basis and the rationale for each determination is noted. Magnitude designations for negative effects are ***negligible, small, medium*** and ***large***. The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue. In the case of a positive impact, no magnitude designation is assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a positive impact.

In the case of impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is used. In addition, the likelihood factor is also considered, together with other impact characteristics, when assigning a magnitude designation while likelihood is considered either possible or likely for impacts from a planned activity.

For biophysical impacts, the semi-quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided as follows:

Negligible Magnitude Impact results in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes are regarded as having no impact and characterized as having a negligible magnitude.

Low Magnitude Impact affects a specific area, system, aspect (physical), group of localized individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localized area.

Moderate Magnitude Impact affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it (physical and biological). A moderate magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

High Magnitude Impact affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) or a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations (physical and biological). A high magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

For socioeconomic impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The quantitative elements are included into the assessment through the designation and consideration of scale and extent of the impact.

6.5.2 Sensitivity of Receptors

In addition to characterizing the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are ranges of

factors to be considered when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, a water body) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered. Where the receptor is biological or cultural (i.e. the marine environment or a coral reef), its importance (local, regional, national or international) and sensitivity to the specific type of impact are considered. Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The universal sensitivity of receptor is low, medium and high.

For ecological impacts, sensitivity is assigned as negligible, low, medium or high based on the conservation importance of habitats and species. For socio-economic impacts, the degree of sensitivity of a receptor is defined as the level of resilience (or capacity to cope) with sudden social and economic changes. Criteria for deciding on the value or sensitivity of biological and socioeconomic receptors are presented as follows:

Negligible: A resource/receptor that has no or very low importance and rarity. The value of the resource/receptor is easily replaceable, or the resource/receptor is commonplace in the context of the assessment scope.

Low: A resource/receptor that has a high capacity to resist change. Recovery/regeneration is spontaneous upon cessation of Project activities. The value of the resource/receptor is considered low or easily replaceable or the resource/receptor is commonplace in the context of the assessment scope.

For ecological receptors, not protected or listed as common / abundant, or not critical to other ecosystem functions (e.g. key prey species to other species). For social receptors, those affected are able to adapt with relative ease and maintain pre-impact status.

Medium: A resource/receptor that has a moderate capacity to resist change. Recovery may require some intervention measures and/or time after cessation of project activities. A resource/receptor that is important locally or regionally in the context of the assessment scope.

For ecological receptors, not protected or listed but may be a species common globally but rare in Turkey with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline. For social receptors, those able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.

High: A resource/receptor with limited or no capacity to resist change and is vulnerable. Recovery will require a long time or may not be possible (permanent loss). A resource/receptor that is important nationally or globally in the context of the assessment scope.

For ecological receptors, specifically protected under national legislation and/or international conventions. Listed as rare, threatened or endangered. For social receptors, those affected will not be able to adapt to changes and continue to maintain pre-impact status.

6.5.3 Assessment of Impact Significance

In order to assess the significance of an impact, the sensitivity of the receiving environmental or social parameter is considered in association with the magnitude of the impact, according to the matrix shown in Table below.

Table 53 : Impact Significance Matrix

Receptor Sensitivity	Impact Magnitude			
	Negligible	Small	Medium	Large
Low	Negligible	Negligible	Minor	Moderate
Medium	Negligible	Minor	Moderate	Major
High	Negligible	Moderate	Major	Critical

While the above matrix provides a framework for the determination of significance and enables comparison across environmental and social parameters, a degree of professional judgement is required, and some parameter-specific factors considered in making a determination of impact significance.

Additional guidance to the degrees of significance in the ESIA is provided below. Positive impacts provide resources or receptors, most often people, with positive benefits. Note that positive impacts are defined, but not rated for significance.

- **Negligible significance:** The impact is hardly distinguishable from background conditions and expected development in a no-project situation or the predicted effect is deemed 'imperceptible' or is indistinguishable from natural background variations.
- **Low significance:** a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
- **Medium significance:** has an impact magnitude that is within applicable standards but falls somewhere in the range from a threshold below which the impact is minor, up

to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

- **High significance:** an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of impact assessment is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP⁵ has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

6.5.4 Mitigation Potential and Residual Impacts

A key objective of an ESIA is to identify and define socially, environmentally and technically acceptable and cost- effective mitigations measures to avoid, reduce, remedy or compensate for potential negative impacts, and to enhance potential environmental and social benefits.

Impacts with negligible and low significance usually do not require any additional mitigation measure. This means that these impacts are within acceptable limits because:

- they are very unlikely to happen; and/or
- the sensitivity of receiving environment is very low; and /or
- project designs have installed sufficient control mechanisms.

For **negligible** and **low significance**, impacts should inherent control measures fail, the implementation of additional control measures should ensure impacts remain acceptable.

⁵ ALARP, which stands for “as low as reasonably practicable” is a principle that aims to reduce residual risk while not incurring unrealistic costs or effort.

Impacts with **medium significance**, deemed as significant impacts, require additional mitigation measures to reduce the impacts at acceptable levels. These impacts can be minimized in order to reach negligible or low levels that are also deemed as acceptable level of impacts (using effective control measures).

Impact with **high significance** generally require imperative mitigation to reduce the significance to lower levels before proceeding with the Project.

Positive impacts should be subject to enhancement measures where possible.

The approach followed to define mitigation measures is based on a typical hierarchy of decisions and measures. The priority is to first apply mitigation measures to the source of the impact (i.e. to avoid or reduce the magnitude of the impact from the associated Project activity); and then to address the resultant effect

to the resource/receptor via abatement or compensatory measures or offsets (i.e. to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

6.5.5 Residual Impact Assessment

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

6.5.6 Cumulative Impacts

Cumulative impacts result from combination of an impact from the Project with an impact from another activity / project. How the impacts and effects are assessed is strongly influenced by the status of the other activities (e.g. already in existence, approved or proposed) and how much data is available to characterize the magnitude of their impacts.

The approach for assessing cumulative impacts is to screen potential interactions with other projects based on:

- Projects that are already in existence and are operating.
- Projects that are approved but not yet built or operating.
- Projects that are a realistic proposition but are not yet built.

There is no project in the vicinity of the proposed Wind Power plant site. Therefore, there will not be cumulative impacts assessment.

6.5.7 Management and Monitoring

The final stage in the IA Process is the definition of the basic management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards/ guidelines; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted. This is covered in section 8 under Environmental and Social Management Plan (ESMP).

6.6 Impact Assessment Criteria

For the purpose of this assessment the following sections define the criteria against which the impacts associated with the 2000 MW Wind Power plant proposed project have been assessed. The impact assessment criteria are general criteria and not specifically associated with the project. Interactions that are likely to lead to significant impacts, as identified during the scoping exercise and baseline conditions are presented in table 51.

Table 54 : Interactions identified that are likely to result in significant impacts

Resource/Receptor	Potentially Significant Impacts
Land Use	• Permanent changes in land use due to installation of WTGs, Central Monitoring Station, Switching Yard, access roads. • Temporary changes in land use due to temporary site office and material storage yard.
Topography and drainage	• Alteration of topography and micro drainage channel due to construction of project site approach road.
Soil Environment	• Decrease of soil quality due to loss of vegetation cover. • Soil erosion during monsoon season and windy periods. • Sedimentation into nearby water bodies due to soil erosion and run-off. • Storage and handling of hazardous materials (e.g., fuel and lubricant) and waste generated from operation of construction equipment and machinery and their maintenance may lead to soil contamination due to leaks/ spillage; and • Impact on soil and land environment due to improper management of domestic solid waste generated.
Ambient Air Quality	• Fugitive dust emissions due to movement of machinery and vehicles; • Fugitive emission due to operation of pile drivers; and • Air emissions due to operations of DG sets and machinery.

Resource/Receptor	Potentially Significant Impacts
Water Environment	• Usage of ground water for construction activities and cleaning of WTGss; • Surface and ground water contamination due to improper disposal of sewage at site; and • Surface and ground water contamination due to spillage of oil, lubricant and hazardous waste.
Ambient Noise Quality	• Noise generation due to movement of vehicles and machineries. • Noise generation due to operation of pile drivers; and • Noise generation due to operation of DG set.
Occupational Health and Safety	• Occupational health hazards due to dust and noise pollution. • Safety risk due to wrong handling of construction machinery, working at heights; and • Exposure of workers to electromagnetic field (EMF) while working in proximity to charged electric power lines during operation and maintenance.

6.6.1 Assessment Criteria for Impact on land Use

For the purpose of assessment of impacts on land use of the area, following project activities, leading to an alteration in land use of the area during construction phase, were considered:

- ✓ Strengthening of access roads and construction of internal access roads.
- ✓ Installation of WTGss.
- ✓ Establishment and operation of temporary structures such as temporary site office (porta cabin) and store yard.

For the assessment of land use, the sensitivity and magnitude criteria outline in tables below have been used respectively.

Table 55 : Sensitivity Assessment Criteria for Land Use

Land Use Sensitivity	Criteria
Low	• Land use not of relevant use by Community • Negligible visual change.
Medium	• Land use of local use by communities e.g. grazing, agriculture, but no major dependence • Visual Change but common feature
High	• Land use of regional importance. Change would impact Land use classification of the area. • Land use of major dependence of local people for agriculture, livestock grazing, settlement etc.

Land Use Sensitivity	Criteria
	Visual Change aesthetically affecting locals.

Table 56 : Criteria for Magnitude of Impact on Land Use

Impact Magnitude	Criteria for land use
Negligible	An imperceptible, barely or rarely perceptible change in land use characteristics. The change may be short term.
Small	Subtle changes in land use character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.
Medium	A noticeable change in land use character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.
Large	A clearly evident, frequently perceived and continuous change in land use characteristics affecting an extensive area. The change may be long term and would not be reversible.

6.6.2 Assessment Criteria for Impact on Topography and Drainage

For the purpose of assessment of impacts on topography and drainage of the area, sensitivity and magnitude criteria have been outlined in tables below.

Table 57 : Sensitivity Assessment Criteria for Topography and drainage

Topography and Drainage Sensitivity	Criteria
Low	Flat topography
Medium	Undulating topography
High	Hilly area

Table 58 : Criteria for Impact Magnitude on Topography and Drainage

Impact Magnitude	Criteria for topography and drainage
Negligible	An imperceptible, barely or rarely perceptible change in topographical characteristics. The change may be short term.
Small	A subtle change in topography character over a wide area of a more noticeable change either over a restricted area or infrequently perceived. The change may be short term to long term and is reversible.
Medium	A noticeable change in topographic character, frequently perceived or continuous and over a wide area; or a clearly evident change over a restricted area that may be infrequently perceived. The change may be medium to long term and may not be reversible.
Large	A clearly evident, frequently perceived and continuous change in topographic characteristics affecting an extensive area. The change may be long term and would not be reversible.

6.6.3 Assessment Criteria for Impact on soil contamination

For the assessment of impacts on soil contamination, the sensitivity and magnitude criteria is as outlines in tables below.

Table 59 : Sensitivity Assessment Criteria for Soil contamination

Soil contamination sensitivity	Criteria
Low	The soil quality does not support diverse habitat or populations and/or supports habitat or population of low quality
Medium	The soil quality supports diverse habitat or population of flora and fauna and supports habitats commonly available in the study area
High	The soil quality supports economically important or biologically unique species or provides essential habitat for such species.

Table 60 : Criteria for Impact Magnitude on Topography and Drainage

Impact magnitude	Criteria for soil contamination
Negligible	Well within standards
Small	Well within standards
Medium	Exceeds Target Value but well within Interventional Value
Large	Exceeds Interventional Value and needs intervention.

6.6.4 Assessment criteria for Impact on soil erosion and compaction

For the assessment of impacts on soil erosion and compaction, the sensitivity and magnitude criteria are as outlines in tables below.

Table 61 : Sensitivity Assessment Criteria for Soil erosion and compaction

Soil erosion and compaction sensitivity	Criteria
Low	The soil quality has little or no role in provisioning of services as agricultural/grazing uses for the local community.
Medium	The soil has local importance in terms of provisioning services as agricultural services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality i.e. ready availability across the study area.
High	The soil is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional level for provisioning services

Table 62: Criteria for Impact Magnitude on soil erosion and compaction

Magnitude Criteria	Soil compaction and erosion
Negligible	Qualitative No perceptible or readily measurable change from baseline conditions Scale- Localized area as Particular activity areas Time-Short duration (few days) or one time as temporary
Small	Perceptible change from baseline conditions but likely to easily revert back to earlier stage with mitigation Scale- Project site, activity areas and immediate vicinity not impacting any sensitive receptor Short term- Only during particular activities or phase of the project lifecycle as civil works or construction phase (few months)
Medium	Clearly evident (e.g. perceptible and readily measurable) change from baseline conditions and/or likely take time to revert back to earlier stage with mitigation Scale- Project site, activity areas and immediate vicinity impacting sensitive receptor/s Long term- Spread across several phases of the project lifecycle (few years)
Large	Major (e.g. order of magnitude) change in comparison to baseline conditions and/or likely difficult or may not to revert back to earlier stage with mitigation Scale- Regional or international. Permanent change

6.6.5 Assessment Criteria for Impact on surface water resources consumption

For the assessment of the project impact due to the consumption of surface water sources during the project activities, the sensitivity criteria and magnitude criteria are outlined in tables have been used.

Table 63 : Sensitivity Assessment Criteria for Surface water Resources

Surface water sensitivity	Criteria
Low	The surface water resource has little or no role in terms of provisioning services as agricultural water source, other domestic uses as washing, bathing, industrial use and waterways for the local community
Medium	The surface water resources have local importance in terms of provisioning services but there is ample capacity and / or adequate opportunity for alternative sources of comparable quality.
High	The surface water resources are wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or transboundary watershed level for provisioning services

Table 64 : Criteria for Impact Magnitude on Surface Water Resources

Impact magnitude	Surface water consumption
Negligible	There is likely to be negligible (less than 1% of lean season flow) or no consumption of surface water by the Project at any time
Small	The Project will consume surface water, but the amounts abstracted are likely to be relatively small in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)
Medium	The Project will consume surface water, and the amounts abstracted are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)
Large	The Project will consume surface water, and the amounts abstracted are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation)

6.6.6 Assessment Criteria for Impact on ground water resources consumption

For the assessment of the project impact due to the consumption of ground water resources during the project activities, the sensitivity criteria and magnitude criteria are outlined in tables below have been used.

Table 65 : Sensitivity Assessment Criteria for Ground water Resources consumption

Ground water consumption sensitivity	Contributing criteria (ground water)
Low	The groundwater resource is not currently abstracted and used in the vicinity of the Project but is of sufficient quality and yield to be used for that purpose in the future (and there is a reasonable potential for future use).
Medium	The groundwater resource is an important water supply, and is currently used, but there is capacity and / or adequate opportunity for alternative sources of comparable quality.
High	The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or national level for water supply or contribution to groundwater dependent ecosystems (e.g. transboundary rivers).

Table 66 : Criteria for Impact Magnitude on Ground water resources consumption

Impact magnitude	Criteria for ground water consumption
Negligible	There is likely to be negligible or no abstraction, use of or discharge to the groundwater by the Project at any time.
Small	The Project will consume groundwater or deliver discharge to groundwater, but the amounts abstracted / discharged are likely to be relatively small in comparison to the resource available at the time of use (i.e., taking into account seasonal fluctuation).
Medium	The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).
Large	The Project will consume groundwater or discharge to groundwater, and the amounts abstracted / discharged are likely to be very significant in comparison to the resource available at the time of use (i.e. taking into account seasonal fluctuation).

6.6.7 Assessment Criteria for Impact on surface Water quality

For the assessment of the project impact on surface water quality due to contamination from accidental spilling of fuel, lubricant and hazardous waste. ...Etc. during the project activities, the sensitivity criteria and magnitude criteria are outlined in tables below have been used.

Table 67 : Sensitivity Assessment Criteria for surface water quality

Surface water quality sensitivity	Criteria
Low	The water resource does not support diverse aquatic habitat or populations or supports aquatic habitat or population that is of low quality.
Medium	The water resource supports diverse populations of flora and / or fauna but available in the surface water bodies in the region.
High	The water resource supports economically important or biologically unique aquatic species or provides essential habitat for such species.

Table 68 : Criteria for Impact Magnitude on surface water quality

Impact magnitude	Criteria for surface water quality
Negligible	Discharges are expected to be well within statutory limits
Small	Discharges are expected to be within statutory limits
Medium	Occasional breach(es) of statutory discharge limits (limited periods) expected
Large	Repeated breaches of statutory discharge limits (over extended periods) expected

6.6.8 Assessment criteria for impact on groundwater quality

For the assessment of the project impact on groundwater quality due to contamination from accidental spilling and infiltration of fuel, lubricant or burial of hazardous waste. ...Etc. during the project activities, the sensitivity criteria and magnitude criteria are outlined in tables below have been used.

Table 69 : Sensitivity Assessment Criteria for groundwater quality

groundwater quality receptor sensitivity	Criteria
Low	The groundwater source does not support diverse aquatic habitat or populations or supports aquatic habitat or population that is of low quality.
Medium	The groundwater source supports diverse populations of flora and / or fauna but available in the surface water bodies in the region.
High	The groundwater source supports economically important or biologically unique aquatic species or provides essential habitat for such species.

Table 70 : Criteria for Impact Magnitude on groundwater quality

Magnitude Criteria	Water quality (ground water)
Negligible	Abstractions from or discharge to aquifer(s) are unlikely to cause water quality issues
Small	Groundwater quality be within ambient levels or allowable criteria or may exceed for 1-2 parameters which is common occurrence due to geological regime of the area. Abstraction or discharge to aquifer(s) may cause small but local changes in water quality in the aquifer system. These can be considered potential short-term localized effects on groundwater quality which is likely to return to equilibrium conditions within a short (months) timeframe.
Medium	Groundwater quality exceeds ambient levels or allowable criteria for key parameters. Abstraction or discharge to aquifer(s) are expected to cause potential localized effects on groundwater quality which are likely to be fairly long lasting and / or give rise to indirect ecological and / or socio-economic impacts.
Large	Groundwater quality exceeds ambient levels or allowable criteria. Abstractions or discharge to aquifer(s) are expected to cause potentially severe effects on groundwater quality which are likely to be long-lasting (e.g. years or permanent) and / or give rise to indirect ecological and / or socio- economic impacts.

6.6.9 Assessment Criteria for Impact on Air Quality

The assessment with respect to air quality of the study area has been done for the following project activities:

- Fugitive emissions from site clearing, excavation work, material handling etc.;
- Fugitive emission from traffic movement.
- Exhaust emission from operation of machineries like pile drivers, vehicles; and
- Point source emission from diesel generator.

The sensitivity criteria and impact magnitude criteria has been provided in tables below.

Table 71 : Sensitivity criteria for air quality

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	Ecological Receptors
Low	Locations where human exposure is transient.	No
Medium	Few Receptors (settlements) within 500 m of the project site	Nationally designated sites.

Sensitivity Criteria	Contributing Criteria	
High	Densely populated receptors(settlements) within 500 m of project site	Internationally designated sites.

Table 72 : Criteria for Impact Magnitude on Air Quality

Magnitude Criteria	Air Quality
Negligible	Soil type with large grain size (e.g. sand); and/or No emissions/dust generation due to Project across all phases Existing ambient air quality of the area is well below the Prescribed NCEC limits
Small	Soil type with large grain size (e.g. sand); and/or Limited emissions/dust generations for short duration Existing ambient air quality of the area is well below the Prescribed NCEC limits.
Medium	Moderately dusty soil type (e.g. silt); and/or Dust generation and emissions from Projects for long duration Existing ambient air quality of the area is within the Prescribed NCEC limits.
Large	Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); and Significant process emissions from Project for the entire Project cycle. Existing ambient air quality of the area is exceeding the Prescribed NCEC limits

6.6.10 Assessment Criteria for Impact on Ambient Noise

The assessment with respect to ambient noise quality of the study area has been done for the following project activities:

- Construction activities including site preparation, piling work, access road widening, construction of ancillary facilities.
- Transportation of construction materials, machinery and personnel.
- Operation of DG sets; and
- Demolition activities during decommissioning phase.

The ambient noise levels have been assessed with respect to NCEC Rules and IFC – WHO Guidelines as shown in tables below.

Table 73 : Measurement noise levels for residential and commercial areas

Category	Daytime $L_{Aeq, T}$ (dB)	Night-time $L_{Aeq, T}$ (dB)
A	50	40
B	55	45

Category	Daytime L _{Aeq} , T (dB)	Night-time L _{Aeq} , T (dB)
C	60	50
D	65	55

Article 7 sets the limits for permitted noise levels at construction sites so that the noise level standards set out in this Regulation are allowed to be exceeded during construction works from 7 am to 6 pm, as indicated in the following table:

Table 74 :Corrective limits for permitted noise levels at construction site

Duration of the construction activities	Correction of permitted noise limits L _{Aeq} , T (dB)
Up to 2.5 hours	10
2.5 to 8 hours	5
Above 8 hours	0

Table 75 : Noise emission criteria

Location	Noise Level Limit (dB(A))	
	Daytime (07:00 – 22:00 hrs)	Night-time (22:00 – 07:00 hrs)
Industrial; commercial	70	70
Residential; institutional; educational	55	45

Source: Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organisation (WHO), 1999.

The above standards have been utilized to create a sensitivity criterion for ambient noise and criteria for impact magnitude for assessment of impact to ambient noise.

Table 76 : Sensitivity criteria for ambient noise

Sensitivity Criteria	Contributing Criteria	
	Human Receptors	Ecological Receptors
Low	Industrial Use	Locally designated sites; and/or areas of specific ecological interest, not subject to statutory protection (for example, as defined by the project ecology team).
Medium	Residential and Recreational place	Nationally designated sites.
High	Educational/ Religious/ Medical Facilities	Internationally designated sites.

Table 77 : Criteria for impact magnitude on ambient noise

Magnitude criteria	Noise quality
Negligible	Predicted noise levels are at or less than 3 dB (A) above the relevant limits / thresholds. Short term exposure (Few hours in a day and not continuous)
Small	Predicted noise levels are 3 to less than 5 dB(A) above the relevant limits / thresholds.
Medium	Predicted noise levels are between 5 and 10 dB (A) above the relevant limits / thresholds. Medium Term Exposure (1 to 6 months)
Large	Predicted noise levels are more than 10 dB (A) above the relevant limits / thresholds. Long term exposure (> 6 months)

6.6.11 Assessment Criteria for landscape and visual impact

For the purpose of assessment of impacts on landscape and visual aspect of the area, sensitivity and magnitude criteria have been outlined in tables below.

Table 78: Sensitivity Assessment Criteria for landscape and visual

Landscape and visual Sensitivity	Criteria
High	Important landscape or landscape resources of particularly distinctive character of high importance, sensitive to relatively small changes.
Medium	Landscape or landscape resources of moderately valued landscape characteristics reasonably to tolerant to change.
Low	Landscape or landscape resources of relatively unimportant landscape characteristics largely tolerant to change.

Table 79 : Criteria for magnitude Assessment of Impact on landscape and visual

Magnitude	Criteria
Large	A substantial / obvious change to the landscape due to total loss of, or change to, elements, features or characteristics of the landscape. Would cause a landscape to be permanently changed and its quality diminished. Change is likely to cause a direct adverse permanent or long term (more than 10 years) impact on the value of the receptor.
Moderate	Discernible changes in the landscape due to partial loss of, or change to the elements, features or characteristics of the landscape. May be partly mitigated. The change would be out of scale with the landscape, and at odds with the local pattern

Magnitude	Criteria
	and landform and will leave an adverse impact on a landscape of recognized quality. Change is likely to impact adversely the integrity/value of the receptor but recovery is predicted in the medium term (5-10 years).
Small	Minor loss or alteration to one or more key landscape elements, features, or characteristics, or the introduction of elements that may be visible but may not be uncharacteristic within the existing landscape. Change is likely to adversely impact the integrity/value of the receptor but recovery is expected in the short term (0-4 years).
Negligible	Almost imperceptible or no change in the view as there is little or no loss of / or change to the elements, features or characteristics of the landscape. The existing landscape quality is maintained but be slightly at odds to the scale, landform, and pattern of the landscape.

6.6.12 Assessment criteria for traffic and transport

For the purpose of assessment of impacts on traffic and transport of the area, receptor sensitivity and impact magnitude criteria have been outlined in tables below.

Table 80 : Receptor Sensitivity for traffic and transport

Sensitivity	Description
High	Receptors of greatest sensitivity to changes in traffic flow, would include: People whose livelihood depends upon unrestricted movement within their environment including commercial drivers and companies who employ them, local residents, schools and colleges. Accident hotspots would also be considered.
Medium	Traffic flow sensitive receptors would include: People who pass through the area habitually, but whose livelihood is not wholly dependent on free access. Would also typically include: congested junctions, community services, parks, businesses with roadside frontage, and recreation facilities.
Low	Receptors with some sensitivity to changes in traffic flow: People who occasionally use the road network. Would also typically include: public open spaces, nature conservation areas, listed buildings, tourist attractions, residential roads with adequate footway provision and places of worship.

Table 81 : Impact Magnitude for traffic and transport

Magnitude	Description
Major	The proposals could result in an appreciable change in terms of length and/or duration to the present traffic routes or schedules or activities, which may result in hardship.
Moderate	The proposals could result in changes to the existing traffic routes or activities such that some delays or rescheduling could be required, which cause inconvenience.
Minor	The proposals could occasionally cause a minor modification to routes, or a very slight delay in present schedules, or on activities in the short-term.
Negligible	No effect on movement of road traffic above normal level.

6.6.13 Assessment Criteria for Socio-economic Impacts

For the assessment of social impacts, the sensitivity and magnitude criteria outlined in tables have been used.

The social impacts associated with the operations and decommissioning stages have been assessed qualitatively and, in some cases, quantitatively (subject to availability of data), using professional judgement and based on experience from similar projects.

Table 82 : Receptor Sensitivity for Local Communities

Sensitivity	Criteria of assessment
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project.
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project.
Low	Minimal vulnerability: consequently, with a high ability to adapt to changes brought by the Project and opportunities associated with it.

Table 83 : Impact Magnitude for Local Communities

Category	Extent / Duration / Scale / Frequency
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional, and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community.

6.6.14 Assessment Criteria for Ecological Impacts

6.6.14.1 Interactions with the project

Interactions that are likely to lead to significant impacts on ecology and biodiversity in the study area are listed in the following table and will be focus of the impact assessment.

Table 84 : Identified interactions that are likely to result in significant impacts

S. No	Potential Impacts	Causes for Impacts
1.	Clearance of vegetation for construction of access roads, ancillary facilities	Loss of scrub habitat that may be used by species spilling over from the forest habitats located northeast and northwest of the site; and Loss of foraging resources, shelter and shade for resident fauna.
2.	Electrocution risk from increased transmission line laying in the region	Roosting on WTGs places avifauna in close proximity to wiring and other electrical components.
3.	Disturbance and displacement of species due to noise, light, anthropogenic movement and traffic	Increased movement of people and vehicles can increase the stress levels of fauna that causes them to spend an increased amount of time in alert mode instead of foraging, nesting, socializing or mating; and Noise, light and uncovered waste can attract or repel fauna to or from the site.
4.	Mortality as a result of worker influx and increased hunting, trapping and poaching of wildlife	The Project site is located near sensitive ecological areas and therefore an influx of workers to the area can result in increased human-wildlife conflicts.
5.	Loss of resources and barrier to movement	Project compound has to be fenced off and therefore fauna cannot access the resources that were formerly located in the Project site; The fenced project site acts as a barrier for animals to move along the large expanse of scrub land present at the Project site; WTGs may attract avifauna for nesting or sitting on it which could causing colliding with moving blades; Heat related to moving parts in WTGs issues on roosting avifauna that could be impacted onto their bodies; and Steel components of WTGs can injure faunal species that have wandered into the Project compound.

6.6.14.2 Assessment Criteria

The sensitivity of ecological receptors is defined by determining the significance of effects on species and habitats separately. The significance tables for species and habitats are given in tables below.

Table 85 : Habitat-Impact Assessment Criteria

Habitat Sensitivity/ Value	
Negligible	Habitats with negligible interest for biodiversity.
Low	Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.
Medium	Habitats within nationally designated or recognized areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.

Table 86 : Species-Impact Assessment Criteria

Baseline Species Sensitivity/ Value	
Negligible	Species with no specific value or importance attached to them.
Low	Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.
Medium	Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.
High	Species on IUCN Red List as CR, or EN. Species having a globally restricted range (i.e. plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km ²), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.

6.6.15 Assessment Criteria for Impact on archaeology and cultural heritage

For the assessment of the project impact on archaeology and cultural heritage, the sensitivity criteria and magnitude criteria are as outlined in tables below have been used.

Table 87 : Sensitivity criteria for archaeology and cultural heritage

Sensitivity / Value	Criteria
High	Sites of international significance: World Heritage Sites National Monuments Protected Structures of international and national importance Designed landscapes and gardens of national importance Architectural Conservation Areas Undesignated archaeological, architectural and/ or cultural heritage sites.
Medium	Recorded Monuments Protected Structures of regional importance Building and Garden Survey Newly identified archaeological sites, confirmed through archaeological investigation or research Undesignated archaeological, architectural and/or cultural heritage sites.
Low	Sites listed for which there are no upstanding remains. Undesignated archaeological, architectural and/or cultural heritage sites. Undisturbed greenfield areas and riverine environs, which have an inherent archaeological potential.
Negligible	Assets with very little or no surviving archaeological architectural and cultural heritage interest.

Table 88 : Criteria for impact magnitude on ambient noise

Impact Magnitude	Criteria
High	These impacts arise where an archaeological, architectural and cultural heritage asset is completely and irreversibly destroyed by a proposed development. A change such that the value of the asset is totally altered or destroyed, leading to a complete loss of character, integrity and data about the site.
Medium	An impact which, by its magnitude, duration or intensity alters an important / significant aspect of the environment. An impact like this would be where an archaeological, architectural and cultural heritage asset would be impacted upon leading to a significant loss of character, integrity and data about the site. Or an impact which by its magnitude results in the partial loss of a historic structure (including fabric loss or alteration) or grounds including the part removal of buildings or features or part removal of demesne land (e.g. severance, visual intrusion or degradation of setting and amenity). A permanent positive impact that enhances or

Impact Magnitude	Criteria
	restores the character and / or setting of a cultural heritage site or upstanding archaeological and architectural heritage site in a clearly noticeable manner.
Low	A low impact arises where a change to the site is proposed which though noticeable is not such that the archaeological, architectural and cultural heritage character / integrity of the site is significantly compromised, and where there is no significant loss of data about the site. A positive impact that results in partial enhancement of the character and / or setting of a cultural heritage site, upstanding archaeological architectural heritage site in the medium to long-term.
Negligible	An impact which causes very minor changes in the character of the environment and does not directly impact an archaeological, architectural and cultural heritage asset, or affect the appreciation or significance of the asset. There would be very minor changes to the character and integrity of the asset and no loss of data about the site.

6.6.16 Assessment Criteria for Impact landscape and visual

For the purpose of assessment of impacts on landscape and visual aspect of the area, sensitivity and magnitude criteria have been outlined in tables below.

Table 89 : Sensitivity Assessment Criteria for landscape and visual

Landscape and visual Sensitivity	Criteria
High	Important landscape or landscape resources of particularly distinctive character of high importance, sensitive to relatively small changes.
Medium	Landscape or landscape resources of moderately valued landscape characteristics reasonably to tolerant to change.
Low	Landscape or landscape resources of relatively unimportant landscape characteristics largely tolerant to change.

Table 90 : Criteria for magnitude Assessment of Impact on landscape and visual

Magnitude	Criteria
Large	A substantial / obvious change to the landscape due to total loss of, or change to, elements, features or characteristics of the landscape. Would cause a landscape to be permanently changed and its quality diminished. Change is likely to cause a direct adverse permanent or long term (more than 10 years) impact on the value of the receptor.
Moderate	Discernible changes in the landscape due to partial loss of, or change to the elements, features or characteristics of the landscape. May be partly mitigated. The change would be out of scale with the landscape, and at odds with the local pattern and landform and will leave an adverse impact on a landscape of recognized quality. Change is likely to impact adversely the integrity/value of the receptor but recovery is predicted in the medium term (5-10 years).
Small	Minor loss or alteration to one or more key landscape elements, features, or characteristics, or the introduction of elements that may be visible but may not be uncharacteristic within the existing landscape. Change is likely to adversely impact the integrity/value of the receptor but recovery is expected in the short term (0-4 years).
Negligible	Almost imperceptible or no change in the view as there is little or no loss of / or change to the elements, features or characteristics of the landscape. The existing landscape quality is maintained but be slightly at odds to the scale, landform, and pattern of the landscape.

6.7 Impact Assessment in Construction Phase

6.7.1 Impact on Land Use

6.7.1.1 Impact source

For the purpose of assessment of impacts on land use of the area, following Project activities leading to change in land use of the area during construction phase were considered:

- Construction/ upgradation of access roads (internal).
- Establishment and operation of temporary structures such as temporary site office (portable cabin) and store yard.
- Vehicular movement for carrying out the plant component and construction materials.
- Movement of construction equipment like cranes, excavators, dumpers, trucks.
- Establishment of WTGs and associated transformer yard; and
- Construction of Central Monitoring Station, Switching Yard.
- Erection of WTGs as well as associated transformer yard and permanent site office.

6.7.1.2 Receptor sensitivity

The proposed Project site is located in a rural setup with no industrial or anthropogenic activities. According to the available information and interviews with the official authorities in the Starah region, there are no current or future projects planned in this zone, and no restrictions or constraints on the project area.

In the pre-construction phase, permanent change will occur to the land use where the project boundaries are established, to prepare for the next phases (construction and operations). In the construction phase, temporary land use changes will occur at contractor facilities and labour camps, material storage areas and there will be a long-term change of the land use where the WTGs and substation will be located. Receptor sensitivity is envisaged to be **low** considering that the proposed site land has no really current use excepted some scattered area for grazing and will change to industrial use.

6.7.1.3 Impact assessment

The establishment of the Wind Power plant will contribute for the energy growing demand on the region for a long term (25 years). Changes in land use are also envisaged for material store yard and temporary site office. However, those changes in land use will take place only during construction period (24 months). Further, the project will require to develop an access road which will be used as the main access road to the project site. magnitude of the impact has been assessed to be **medium to small**. The overall impact significance will therefore be **minor**.

Table 91: summary of impact on land use during construction phase

Impact	Changes in Land use during construction				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Limited to WTGs footprint and construction areas and associated facilities				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor .				

6.7.2 Impact on topography and drainage

6.7.2.1 Impact source

Construction activities will include pre-construction site clearance and grading prior to the installation of operational infrastructure, excavation works for turbines supporting structures and creating internal of access roads. These works will induce modification of some natural micro drainage natural channels.

6.7.2.2 Receptor sensitivity

The project area exhibits flat and uniform topography with no major undulations. There are no water bodies that pass through the proposed project site. Typically, Wind Power projects do not undertake levelling of topography and since the proposed project, along with the access road, is mostly on a flat terrain. the receptor sensitivity has been assessed to be **low**.

6.7.2.3 Impact assessment

Thanks to non-undulating topography, study area does not exhibit presence of micro drainage channels. Though the Wind Power project does not require levelling of land, construction of access road for the project purpose could potentially alter topography but the chances of that are miniscule. Therefore, the impact magnitude has therefore been assessed as **small to medium**.

construction activities are not anticipated to be extensive, and this impact is assessed as being of **minor significance**.

Table 92: summary of impact on topography and drainage during construction phase

Impact	Changes on topography and site drainage				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction areas and associated facilities				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor .				

6.7.3 Impact on soil contamination

6.7.3.1 Impact source

Municipal and hazardous waste, wastewater and spills and leaks of oils and fuels and many other chemicals may contribute to soil pollution if not managed properly during the construction phase. on site during construction phase.

6.7.3.1.1 Soil contamination due to waste generation

General construction waste generated onsite will comprise of concrete, steel cuttings/filings, packaging materials, wood, glass, plastic and other metals.

Municipal solid wastes consisting of food waste, plastic, glass, aluminium cans and wastepaper will also be generated by the construction workforce at canteen facility/ labor camp. This waste will contaminate soil if not handled properly.

A small proportion of the waste generated during construction phase will be hazardous. This waste includes waste fuel, greases, broken spare parts, paints for WTGs parts and switchyard structures, chemicals and waste oil containing rags which if not managed properly, may lead to contamination of soil

6.7.3.1.2 Soil contamination due to leaks and spills

The project will involve the use of paints for WTGs parts and switchyard structures during construction which if not handled and used properly, may lead to contamination of soil.

Improper disposal of hydraulic fluids, diesel, lubricating oils and other used oils can also result in contamination of soil. Improper storage of construction material can also result in the unwanted dispersal of contaminants into adjoining areas.

Spills could have a long-term impact on soil quality but are expected to be localized in nature. Spill control measures such as the storage and handling of chemicals and fuel in concreted areas will be implemented to minimize impacts in the event of a spill.

The soil in the Project area is not contaminated as there is no anthropogenic activity in the project area.

Diesel storage will be provided at batching plant onsite during construction phase. Wastewater will be storage tank to be disposed in proper place. Other materials such as oil, greases, paints, and solvents will be stored in drums in storage area and having restricted access. improper handling of chemical/fuel storage, lubrication oils and wastewater may lead to spills and leaks and then to soil contamination.

Soil contamination during the construction phase may result from leaks and spills of oil, lubricants, or fuel from heavy equipment. Leaks and spills may occur also during preventive and corrective maintenance operations of construction machinery and vehicles. Such spills could have a long-term impact on soil quality but are expected to be localized in nature.

6.7.3.2 Receptor sensitivity

Situated in a barren territory, the soil in the Project area is not contaminated as there is no anthropogenic activity. Receptor sensitivity is assessed to be **low**.

6.7.3.3 Impact assessment

The potential of the soil contamination of the brought material is normally known. Once the nature of soil is known, sufficient controls will be implemented to ensure that any impacts to existing soil contamination will be **medium to small**. The overall impact significance will be assessed as **minor**

Table 93: summary of impact on soil contamination during construction phase

Impact	Changes on soil contamination				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction areas and associated facilities				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor .				

6.7.4 Impact on soil compaction

6.7.4.1 Impact source

The project will undertake the soil compaction activity to ensure soil stability during the establishment of storage areas, labour camp, access road, installation of batching plant, establishment of substation, control building... etc. During construction activities, there would be compaction of soil in the Project area during movement of vehicles/ construction machinery and work force movement. In addition, laying of electrical wires during erection of internal electrical lines will also lead to the compaction soil to certain extent. No adverse impact on the soil in the surrounding area is anticipated.

The soil compaction would lead to impact on the soil physical properties such as reduction in pore spaces, water infiltration rate, and soil strength...etc.

Usage of the existing roads with minor strengthening by vehicles will be encouraged. The usage of existing roads by vehicles and minimal access road construction will reduce the impact from soil compaction in the area.

However, in order to minimize such impacts, appropriate soil erosion control measures would be undertaken by Developers of wind turbines and associated structure to appease the chances of soil erosion.

The site clearance, excavation for foundation and access road construction will largely affect the top layers of the soil. Loss of topsoil quality would have an impact on the vegetation cover grow in the land, but the effects can be reversed over time. Further, site clearance will be restricted only in the project site. Potential grazing land close to the project site will not be disturbed.

6.7.4.2 Receptor sensitivity

The receptor sensitivity has been assessed as **low** because of the absence of any anthropogenic activity in the site or any agricultural activity to be a likely a source of livelihood area.

6.7.4.3 Impact assessment

As the soil compaction will be restricted within the project boundary and its extent is expected to be limited to the impact significant due to the soil compact is considered as **medium** to **small**.

The impact magnitude therefore has been assessed to be **minor**.

Table 94: summary of impact on soil compaction during construction phase

Impact	Impact on soil texture and compaction				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction areas and associated facilities				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor .				

6.7.5 Impact on surface water availability

6.7.5.1 Impacts sources

The potential sources of impact on surface water resources are as follows:

- Surface water abstraction for construction work and domestic purposes.
- Earthworks in the project area may increase the erosion, especially during rainfall events, which may increase the suspended sediment concentrations and pollute water sources.
- Sewage will generate from the construction workforce (toilets and washing facilities) and from drainage from cooking activities.
- Liquid effluents will also arise from washing of construction equipment and vehicles.
- Inappropriate storage of construction waste, material storage that leading to water quality impacts from runoff entering the water resources close to project area.

6.7.5.2 Receptor sensitivity

There is no surface water resource identified in the footprint of the project area. The water demand for civil works, dust control cleaning of WTGs and for sanitary needs will be brought to the project site by tankers. Using water tankers filled from nearby surface water bodies will affect the surface water resources availability in the region. The scarcity of water in the region will accentuate this water stress condition. Therefore, sensitivity of surface water resources will be assessed as **medium** to **high**.

6.7.5.3 Impact assessment

During the construction phase, the primary water use requirement will be for dust control. However, water may also be required to moisture condition the soils for proper compaction of internal roads and foundations within the site premises. Temporary ablution facilities will be required during construction (i.e. portable toilets). Water will be required for foundation work and domestic requirement of workers. Water will be brought by tankers to the site. No water source in vicinity will solicited to meet the total demand of the project in construction phase. However, The Project obtains its water from closest surface water bodies available in the region that are available year-round for the population and can put on stress the water requirement for the region.

Considering that the construction phase will last only 24 months, the impact magnitude can be assessed as **small**. Then the impact significance can be classified as **moderate**.

Table 95: summary of impact on surface water availability during construction phase

Impact	Impact on surface water availability				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area and settlements around the project				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered minor .				

6.7.6 Impact on groundwater availability

6.7.6.1 Impact source

Water is a prime requirement for the execution of civil works, especially with regard to preparation of raw materials like concrete etc. for civil works associated with the Project (i.e. WTGs foundation casting, construction of proposed site office, control room). approximately **55 m³/day** of water will be required for civil works during the construction. Approximately **290 m³/day** of water will be required for dust suppression activities. Tankers water through authorized vendors will be the main source of water (by tankers) for construction activity while bottled water will be used for drinking purpose.

According to geotechnical campaign, it is noticed that no shallow groundwater was found until the depth of 10 m. construction of borewells within the site to cater to the domestic water requirement or civil works or dust control is not proposed.

6.7.6.2 Receptor sensitivity

Since groundwater resources will not be utilized for the project activities, the receptor sensitivity is assessed to be **low**.

6.7.6.3 Impact assessment

construction phase of the Project will last for a short period of time (24 months). Using groundwater by construction of borewell during this period of time seems to have a **negligible** to **small** impact if it were existing. But bringing water by tankers seems to be the therefore the

most economical solution for the project. The significance of impact on groundwater resource is then assessed as **negligeable**.

Table 96: summary of impact on ground water availability during construction phase

Impact	Groundwater availability				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area and settlements around the project				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered negligible .				

6.7.7 Impact on surface water quality

6.7.7.1 Impact source

6.7.7.1.1 Contamination of surface water by wastewater

As the construction camp will be set up in the project premises and sanitary facilities including toilets and showers will be provided for the use of the construction workforce both on-site and at the worker's accommodation. Such liquid effluent streams are likely to be high in organic matter, suspended solids, bacteria, and other pollutants. Septic tanks will be provided to treat sanitary wastewater. Surface water quality might be contaminated due to the accidental spills/leaks at the storage areas. A small volume of wastewater from the washing of equipment and machinery may also be generated. This wastewater may contain concentrations of suspended solids and traces of hydrocarbon. The contractor will be responsible for ensuring that any wastewater discharges meet the standards stipulated by the Executive Regulations of Law of Treated Sewage Water and its Reuse by the MOWA/IFC EHS guidelines 2007.

6.7.7.1.2 Contamination of surface water by spills/leaks

Surface water can be contaminated due to accidental spills/leaks of oil, greases, fuel from construction machinery or storage facilities of these materials. It can be also contaminated by solvents paints and other chemicals products if not handled properly. Even there is no surface

water identified in the footprint of the project, the risk of contamination exists and concerns the surface water source of the region by carrying these pollutants by runoff and wind erosion

6.7.7.1.3 Contamination by load of sediments

Soil compaction and vegetation clearance may increase the intensity and volume of surface water runoff as a result drainage lines within the site will be impacted by the increase of sediment load that will be dumped in the nearest water surface

6.7.7.2 Receptor

Scarcity of surface water in the region gives the source a great importance for the neighboring population and doesn't have any alternative. The sensitivity of the receptor can then be assessed as **medium**.

6.7.7.3 Impact magnitude assessment

Potential impacts are expected to be short-term, and extent will be localized. Therefore, the impact on surface water from wastewater discharges, sediments loading or leaks and spills for hazardous waste during construction is assessed to be **minor**.

Table 97: summary of impact on surface water quality during construction phase

Impact	Surface water contamination by wastewater/leakage and spills /sediments load				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area and settlements around the project				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.8 Impact on groundwater quality

6.7.8.1 Source of impacts

Topsoil clearance and soil compaction may increase the intensity and volume of surface water runoff as a result of a decrease in water infiltration recharging the groundwater.

Improper disposal of sewage and wastewater from a labour camp and construction debris can contaminate the groundwater resources in the area. The hydrogeology of the project area could

potentially be affected if any leaked hydrocarbons permeate into the sub-surface and through cracks in the bedrock geology come into contact with the groundwater. Groundwater contamination during the construction phase may occur from unplanned events such as leaks and spills of oil, lubricants, fuel from heavy equipment, chemicals and improper handling of sewage. The risk of contamination is enhanced by nature of the soil which is characterized by a high rate of percolation.

6.7.8.2 Receptor sensitivity

Since there is no utilization of groundwater in the footprint of the project. And the potential contamination of groundwater from improper handling of fuel, waste and liquid effluents is a long-term process, then receptor sensitivity is assessed to be low. direct impacts to groundwater quality from construction, proper handling of fuel, waste and liquid effluents, the impact to groundwater from spills and leaks is assessed to be **medium**.

6.7.8.3 Impact assessment

Contamination of groundwater is unlikely to happen in a short-term procedure due to depth of groundwater. Then the direct impact magnitude on groundwater contamination is assessed to be **small to negligible**. Then, the impact significance will be **minor**.

Table 98: summary of impact on groundwater quality during construction phase

Impact	groundwater contamination				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.9 impact on air quality

6.7.9.1 source of impact

The main impacts associated with construction activities will be:

- **Dust Generation:** Resulting from earthworks such as leveling, grading, excavation works and movement of vehicles across dirt/unpaved roads, especially during windy conditions, construction of approach road, construction of WTGs foundation, construction of building, loading and unloading equipment, dust generated from stockpiles of waste, topsoil handling and moving excavated material and transporting wastes on vehicles.
- **Exhaust Emissions:** Exhaust emissions of SO₂, NO_x, CO, CO₂, PM_{2.5} and PM₁₀ will be attributed predominantly to the construction of the plant, DG set operation and road vehicles such as movement of trucks and vehicles during construction work.
- **Odors:** resulting principally from handling of sewage and wastewater.

6.7.9.1.1 Dust from Construction Activities

The presence of dust can be a nuisance to site users, including construction workers and other nearby receptors. The levels of dust at the site are expected to be variable and dependent on the time of year, the intensity of the activity and the prevailing winds. During the construction phase, dust will be generated from increased vehicle and heavy machinery movements, from trucks driving on unpaved roads and from activities that cause disturbance of the soil.

Dust becomes airborne due to the action of winds on material stockpiles and other dusty surfaces, or when thrown up by mechanical action, for example, the movement of tires on a dusty road or activities such as excavating. The quantity of dust released during construction depends on a number of factors, including:

- the type of construction activities occurring.
- the area of exposed materials.
- the moisture and silt content of the materials.
- distances travelled on unpaved surfaces; and
- the mitigation measures employed.

The key construction activities likely to result in increased dust levels are site cleaning, excavation work, cutting and levelling work, movement of trucks transporting WTGs infrastructure to the site, water transportation, movement of construction vehicles along dusty roads, clearance of vegetation, trenching, burial of cables and screwing/ piling support poles of structures into the ground. Dust emissions are exacerbated by dry weather and high wind speeds. The impact of dust also depends on the wind direction and the relative locations of dust sources and receptors.

The site workers will be affected by construction dust as well as the people living near the site of the approach road.

6.7.9.1.2 Exhaust emissions during construction activities

In addition to dust generation, construction vehicles and other construction equipment will generate exhaust emissions. Heavy equipment such as bulldozers, excavators, dump trucks, and compactors will be used onsite. Emissions from this equipment and from diesel generator sets used to generate power will cause impacts to ambient air quality. It is not anticipated that large volumes of exhaust emissions will be generated during the construction phase of the Wind power plant facility.

The implementation of the good site practices, such as the regular maintenance of vehicles and equipment, using cleaner fuels and switching off vehicles when not in use will be used to reduce exhaust emissions from the operation of the diesel-powered construction equipment and therefore, minimize adverse air quality impacts.

6.7.9.1.3 Odours

There is the potential for release of associated odour to the immediate surrounding areas associated with inappropriate containment and coverage associated with wastewater holding/septic tanks. Any such impacts are likely to be temporary and limited to the immediate surrounding area.

Such impacts may only occur at the local construction camp or laydown area, which as any receptor is less sensitive to changes in air quality. All receptors will be located at greater distances from the construction camp by which point odor is not expected to be discernible.

6.7.9.2 Receptor

There is potential that the construction workforce for the project may be impacted by the impacts stated above (as a result of construction) and as a result of existing air emission sources. The risks from site generated air emissions (i.e. dust and vehicle/equipment emissions) can be managed via a robust CEMP and associated air quality management plan.

However, the risk to the workforce is considered to be low. This low risk is not further considered in the potential impacts section, but monitoring recommendations are included herein, as a precautionary approach to protect the workforce.

For population in the footprint of the project site, there is no settlement adjacent to the project site in the ray of at 500 m. the only population exposed to dust are workers on site. Receptor's sensitivity is assessed as **low**.

6.7.9.3 Impact assessment

6.7.9.3.1 Impacts of dust from construction activities

It is noticed that no settlement is located more within 500 m far from the project site. Traffic movement for carrying out construction materials and parts of WTGs will generate dust to the local resident due to the presence of household close to the access roads.

On the basis of soil nature (silty sand according to geotechnical analysis), the magnitude of the impact associated with the emission of dust during construction activities is predicted to be **small to medium**.

The impact significance is assessed as **moderate**.

Table 99: summary of impact of dust on air quality during construction phase

Impact	Impact of dust on air quality				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.9.3.2 Impacts of fugitive emissions

The air quality impacts associated with the vehicular and equipment emissions during construction activities are assessed to be of low potential significance. This implies the effects to be of localized nature and temporary which indicates that any deterioration in air quality at project location is unlikely to be significant and is expected to be transient. The impact magnitude due to the fugitive emissions from the vehicles and construction machinery is assessed to be **small to medium**. Thus, impact is significantly **minor**.

Table 100: summary of impact of dust on air quality during construction phase

Impact	Impact of fugitive emissions on air quality				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.9.3.3 Impacts of odours

Odours will be generated from wastewater holding/septic tanks, portable toilets. odors smelling will be limited in time and space during construction phase. Then impact magnitude of odours will be assessed **small to medium**. Thus, the impact is significantly **minor**.

Table 101: summary of impact of dust on air quality during construction phase

Impact	Impact of odors on air quality				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.10 Impact on ambient noise

The proposed wind energy facility will be located in an area with a rural character which is fairly remote. Increased noise levels are directly linked with various activities associated with the construction phase.

6.7.10.1 Sources of Impact

Following project activities were considered for the purpose of impact assessment on ambient noise levels during the construction phase:

- Construction activities including site preparation, construction of WTGs foundation, operation of earthmoving and excavation equipment, building, and substation construction.
- Transportation of WTGs, WTGs mounting structure and components, construction material, construction machinery, and personnel.
- Operation DG sets;
- Operation of batching plant.
- Digging of trenches to accommodate underground power cables.

The equipment likely required to complete the above tasks will typically include Excavator, Graders, bulldozers, dump trucks, vibrating roller, wheel loader, rock breaker, flatbed trucks, concrete trucks, cranes, forklifts and various four-wheel drive and service vehicles.

Typical noise emissions for plant and equipment likely to be deployed in Starah Wind Power plant are listed in Table below.

Excessive noise, particularly when experienced continuously, outside normal working hours and on rest days, can be a nuisance to workers. In extreme cases, it may become a health hazard.

Table 102 : Noise Emission Levels for some construction machinery

Equipment	Typical Noise Level (dBA) 50 ft from Source*
Air Compressor	81
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane Derrick	88
Crane Mobile	83
Dozer	85
Generator	81
Grader	85

Equipment	Typical Noise Level (dBA) 50 ft from Source*
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rail Saw	90
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	88

6.7.10.2 Receptor sensitivity

Since there is no settlement within the boundary of 500 m far from The Project site. The few households and camps located within the 200m of the access roads, will be temporary affected by the movement of the vehicle, trucks... etc. holding construction materials and water. The sensitivity can be defined as **low**.

6.7.10.3 Impact assessment

A significant source of noise during the construction phase is additional traffic to and from the project site as well as traffic on the site. The use of borrow pits and a concrete batching plant will significantly reduce heavy traffic vehicle movement to and from the site.

Construction traffic is expected to be generated throughout the entire construction period; however, the volume and type of traffic generated will depend on construction activities being

conducted which will vary during the construction period. Movement of traffic during night hours can also disturb the local community in both sides of access road.

As there is no population within the 100 m around the project site and the noise nuisance will be limited to the traffic movement for population near to access roads and workers onsite. The impact of noise can be assessed as **small to medium**.

Table 103: summary of impact on ambient noise during construction phase

Impact	Impact on ambient noise				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.11 Impact on traffic and transport

6.7.11.1 Source of impact

The construction phase shall involve transportation of construction materials, blades and other parts of WTGs, equipment and mounting structures. The existing roads/paths leading to the project site are not suitable for carrying construction and plant material; therefore, a new access road will be constructed. The access road plan will be finalized during the detail design stage.

Some of construction workforce will travel on a daily basis to the site over the arterial roads in the cities close to the project site and will, therefore, have an impact on local traffic and transportation.

It's anticipated that traffic levels will increase during construction phase due to transportation of construction materials, WTGs parts, water and other equipment. The traffic augmentation will be remarkable especially on roads leading to the project site.

The volume of traffic will vary over the course of construction depending on the phases of construction and the demand for materials, water, removals, and construction personnel on site. The main factors that will affect the number of vehicles on the roads will be related to manpower needs, material usage and waste generation.

6.7.11.2 Receptor

As mentioned in project description all project construction materials, equipment, water, WTGs will be transported to the site via ground route via principally existing access roads. Traffic level through the localities in proximity situated along these roads will be affected due to the additional traffic movement occasioned by the transit of heavy vehicles and other type vehicles. The receptors exposed to impacts from construction phase movements and personnel are the existing users of the road as well as nearby residents of these localities. This roadway and local users are the main receptors considered in this assessment. This road is certainly used by the local people and people from the eastern regions to go to attend pilgrimage and other purposes. The receptor sensitivity is assessed to be **medium**.

6.7.11.3 Impact assessment

The construction activities will require transportation of construction material, WTGs parts, WTGs mounting structure and construction material to the site. The project construction activities will lead to additional traffic and increased risk of traffic-related accidents and injuries to the community and to workers. Such impacts arise almost entirely during the construction period. The increase in traffic due to the project is, however, going to be marginal. Transportation of construction material in open trucks /tippers can also lead to dust generation along the route. Excess traffic on the road will create discomfort for locals due to increment in noise level and fugitive dust and gaseous pollution expected to exhaust from the vehicles. The impact magnitude due to the traffic movement is assessed as **small** to **medium**. Thus, impact significance is assessed as **moderate**.

Table 104: summary of impact on traffic and transport during construction phase

Impact	Impact on traffic and transport				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area / settlements in vicinity of the project				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.12 Impacts on ecology and biodiversity

It is anticipated that during the construction phase site preparation activities will take place (such as excavations, levelling, land clearing activities, etc.) for the various Project components. Such activities are expected to cause a major disturbance and removal of the semi-natural vegetation present at the project site, including the grasses and the trees. Such activities could also cause regular disturbance to the other wildlife species inhabiting the Project Site. Other impacts on the biodiversity of the site could be caused by improper management of the site, which could include improper conduct and housekeeping practices by workers (i.e., hunting of animals, discharge of hazardous waste to land, etc.).

As discussed in the results above, generally the Project Site is generally arid with very low vegetation cover and wildlife species presence. As mentioned earlier, no threatened flora/fauna species or sensitive habitats have been observed within the Project Site and all recorded floral and faunal species are considered to be of least concern. The literature review also has not identified any globally threatened species, except for the Egyptian Spiny-tailed Lizard (Vulnerable) and Arabian Sand Gazelle *Gazella marica*. Both species are not expected to be present, if at all, in significant numbers. No burrows were observed at the Project Site for the former while the latter is a species that is known to have a wide home range and its presence in large numbers at the Project Site and its vicinity is improbable due to the obvious high levels of disturbance caused by grazing and traffic along the main roads close by.

In addition, the Project site is not located within any area of nature conservation concern such as protected areas and/or Key Biodiversity Areas (KBAs), including Important Bird and Biodiversity Areas (IBAs). However, the Project Site is located around 5km to the northwest of the boundaries of Mahazat As-Sayd KBA/PA.

Given all of the above, the potential impacts on biodiversity created during the construction phase would be of a long-term duration as they would result in a permanent change in the natural biodiversity of the site. Such impacts are considered of negative nature and of a **small** to **medium** magnitude given that the change in the natural biodiversity of the site will be noticeable in limited individual footprints. However, as the site is considered of **low** ecological significance, the receiving environment is determined to be of a **low** sensitivity. Given all of the above, such an impact is considered to be of **minor** significance.

Table 105: summary of impact on ecology and biodiversity during construction phase

Impact	Impact on ecology and biodiversity				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area / settlements in vicinity of the project				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.13 impact on occupational health and safety

The development of the proposed wind energy facility will involve a range of activities that could potentially be unsafe to workers and the local community without mitigation measures. Examples of such activities include excavation for WTGs support structure foundations, use of drills for cutting, working at heights, trenching, etc. Such activities require the use and operation of heavy-duty earth moving equipment, machinery and vehicles.

6.7.13.1 Impact source

The sources of impact on the health and safety of the Project construction workforce are listed below.

- Accidents and injuries associated with the operation of heavy machinery and other construction activities; and
- Health impacts associated with environmental conditions and changes in environmental quality, arising from emissions of air, water pollution and noise generation from construction activities as well as from storage and handling of waste, particularly hazardous waste.
- Loading and unloading activities of the construction materials
- Working at height, working with rotating machinery and falling objects

6.7.13.2 Receptor sensitivity

The receptors of the impacts on occupational health and safety include the workers, both regular and contractual working on the project. The construction workforce is estimated 800 workers during construction phase (24 months) will be exposed to occupational health and safety impacts

arising from construction activities of Wind power plant. Sensitivity of receptor is assessed as **medium**.

6.7.13.3 Impact assessment

The construction activities include site preparation, infrastructure utilities installation and building structures. Loading and unloading operation of the construction material may cause an injury if not handled properly. During construction works, physical injury results due to road accidents, construction accidents, and other occupational hazards. Overexertion injuries and illness are potentially the most common health hazards associated with construction activities. Further, there is potential for slips and fall on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction material, liquid spills and uncontrolled use of electrical cords and ropes on the ground which results in injuries and time loss during construction.

Hazards associated with fall of construction material or tools, as well as the collapse of constructed slabs, walls and roofs can result in injury to head, eyes, and extremities. Transportation and movement of vehicles are associated with road accidents and related hazards, which can lead to injuries and fatalities.

Therefore, there will be potential impacts on worker’s health and safety due to exposure to risks through construction activities that lead to accidents causing injuries and death. The most frequent risks cause of accidental death and injury are:

6.7.13.3.1 Safety Risks

- Tripping due to uneven surfaces, obstacles, trailing cables;
- Falling during working at height due to fall from fragile surfaces, roof edges, and ladders;
- Fire due to hot works, smoking, failure in electrical installations;
- Mobile plant and vehicles; and
- Electrical shocks.

6.7.13.3.2 Health Risks

- Manual handling and musculoskeletal disorders: typical construction activities that can cause injury such as lifting, lowering, pushing, pulling and carrying
- Hand-arm vibration: people work with hand-held or hand-guided power- tools and machines, such as concrete breakers, pokers and compactors, sanders, grinders and disc cutters, hammer drills, chipping hammers, chainsaws, scrabbles and needle guns.

- Temporary or permanent hearing loss which usually comes from noise generated from machinery used for excavation or piling work and from compressors and concrete mixers etc.
- Heat stress and working at high temperatures.

These risks could create long-term impacts to the health and safety of the construction workforce and therefore the impact magnitude is assessed to be **medium** without advanced mitigation measures. So, the impact significance on occupational health and safety during construction phase has been assessed as **Moderate** without taking mitigation measures.

Table 106: summary of impact on occupational health and safety during construction phase

Impact	Impact on occupational health and safety				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate .				

6.7.14 socio-economic impacts

6.7.14.1 impact on community health and safety

As per IFC EHS guidelines (2007), the occupational and community health and safety hazards during the construction, operation, and decommissioning of Wind Power projects are generally similar to those of most large infrastructure projects if fact:

- During construction phase, various project components such as transmission cable laying, switchgear, internal road network and porta cabin construction will require land clearing, levelling, excavation and grading activities. Vehicle movement will also take place. This will result in an increased level of dust and particulate matter emissions, as well as high traffic load, which in turn will directly and temporarily impact the local community. If improperly managed, there is a risk of nuisance and health effects.
- The construction of Wind power plant activities will generate different types of solid and liquid wastes and hazardous that should be managed properly otherwise:

- ✓ Improper disposal of these wastes can lead to littering in the construction site and surrounding areas. Hazardous wastes such as waste oil, lubricants, hydraulic oil etc. can cause contamination of soil and water bodies if adequate precautions for management and handling are not undertaken.
- ✓ Improper disposal of solid waste from the labor camps at the site and lack of proper sanitation facility for labor can lead to unhygienic conditions due to open defecation and spread of diseases in the area. It can also lead to the discontent of the local community and result in conflicts with the labor engaged at the site.
- ✓ Taking the distribution of impact as within the site, duration as short, the impact can be considered as **"minor"**

Table 107: summary of impact on community health and safety in construction phase

Impact	Impact on community health and safety				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area / settlements around the project				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.14.2 Impact on employment opportunities

6.7.14.2.1 Source

The project is likely to create a range of avenues for direct and indirect employment opportunities:

- The requirement for around 800 laborers in the construction phase can spur local labor contracting activities as well as avenues of unskilled labor;
- Self-employment options for individuals possessing vocational or technical training skills like electricians, welders, fitters etc, which are likely to be sourced locally.
- Contracting opportunities for locals possessing tractors, trucks or other vehicles which would be needed during construction phase for material and personal transportation.

6.7.14.2.2 Receptor

Local population living near to the project site will be benefited.

6.7.14.2.3 Impact Assessment

The construction phase activities of the project including construction of access road, civil works, foundation activities, site clearance and security will involve skilled, semi-skilled and unskilled workers including technicians, electricians, welders, mechanics...etc., who are likely to be recruited from the local community.

Furthermore, the community will be benefited from the project in terms of the cars, trucks, heavy machinery drivers hired by the project. The project is also likely to create a number of indirect economic opportunities in terms hiring tractors, trucks.... etc. As the project development will generate the employment opportunity so it is assessed as the **positive** impact.

6.7.14.3 Impacts from Migrant Workers

The entire construction phase for the Project is scheduled to be undertaken under in 24 months. The approximate working population for both civil and mechanical work is expected to be around 1100 persons. This will require labor of unskilled, semi-skilled, skilled and highly skilled nature. However, it is envisaged that outsourced personnel will comprise mostly of skilled laborer and workers.

The Construction Contractor will be responsible for the construction of temporary labor camps and provide the workers with water supply, electricity, sanitary facilities, medical aid and other basic amenities. It is assumed that the camps would be constructed in-situ. Following impacts are envisaged due to influx of migrant workers.

6.7.14.3.1 Social Impacts of Migrant Workers

Due to the migrant worker influx in the project area the following impact may arise:

- Frequent movement of vehicles may increase accidents.
- Sharp increase in daily wage rates for labor, impacting the availability of other working activities; and
- On the contrary, there could be an enhancement of local skills and skill sets through interaction of local unskilled or semi-skilled laborers with the skilled migrant workers.

6.7.14.3.2 Community Health Impacts from Migrant Workers

As the project worker will live in the temporary construction camp and surrounding area in a rental basis. The following health risk may be brought out due to the migrant worker:

- Spread of communicable diseases, especially infectious diseases, which accompany many major constructions.
- Poor health infrastructure in the Project area may worsen the spread of any disease.
- Lack of hygiene and adequate sanitation facilities would create health ailments related to food poisoning or diseases.

As most of the unskilled worker will be recruited from the local community therefore migrant worker will less. So, the impact due to the labor influx during the construction phase on community people has been assessed as **minor** without taking mitigation measures.

Table 108: summary of impact of migrant workers during construction phase

Impact	Impact on community of migrant workers				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	construction area / settlements around the project				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.7.15 impact on archaeology and cultural heritage

The site does not contain any archaeological monuments or sites as per the last site visits and walkover. No impact is envisaged both during construction and operation phase.

6.8 Impact Assessment in Operation and Maintenance Phase

Due to increased activities and efficient operational systems, there will be some impacts on the environmental setup in the project area, which are discussed hereunder. In order to achieve sustainability of the development works, it is necessary to ensure the effectiveness of mitigation measures even after construction, as some adverse environmental impacts may result from the operation of the project facilities. Therefore, in order to reap the full environmental benefits of the project activities and ensure environmental enhancement, it would be necessary to implement a good monitoring plan for these activities.

6.8.1 Impact on Land and Soil Environment

6.8.1.1 Sources of Impact

The following activities will lead to an impact on soil quality:

- Monitoring of wind power plant operation
- Routine maintenance activities at WTGs
- Material Handling and Storage.
- Hazardous and Non-Hazardous Materials and Waste Management during maintenance activity

6.8.1.2 Receptor

The operational phase of the project will have limited impacts on the soil in form of waste generation and soil contamination due to accidental spillages/leakage. Receptor sensitivity is assessed as **medium**.

6.8.1.3 Impact Assessment

6.8.1.3.1 Impact on Land due to Improper Waste Disposal

During operation phase, the waste generated from the project will include domestic solid waste at SCADA building and substation, and hazardous waste like waste oil and lubricants and oil containing jute and rags will be generated during maintenance activities. Operation of WTGs for wind power generation will not have a direct impact on soil. However, the water as may use for washing activities may contaminate the soil if the chemical is used for washing. The quantity of hazardous waste generated will be much lesser quantity than during the construction stage. The WTGs will have many gears oil/hydraulic oil shall be required for this system. waste oil/grease from operation and maintenance of nacelle components maybe generated. Maintenance of WTGs their change may produce solid waste as used spare parts, glass wastepaper wood packing cartons, plastics if this waste is not handled properly, it would be scattered all about the project site. the impact has been assessed as **moderate**.

Table 109: summary of impact of improper waste disposal during operation phase

Impact	Impact of improper waste disposal				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site / settlements around the project				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate .				

6.8.1.3.2 Soil Contamination due to Leaks/Spills

There are chances of spillage of oil during maintenance work such as lubricating oils from, gearboxes, transformers, utilities machinery and vehicles on site. The accidental spillages at oil/lubricants and hazardous waste storage areas may cause contamination of soil and groundwater. The probability of the impact is only during the maintenance and therefore occasional. In case of accidental spillage, the impacts will be confined to the maintenance area and storage area. The impact on soil due to leaks/spills has medium intensity with low probability and assessed as **moderate** significance without mitigation measures.

Table 110: summary of impact on soil contamination by spills and leaks during operation phase

Impact	Impact of improper waste disposal			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Wind Power plant site			
Impact frequency	During operation and maintenance phase			
Impact Likelihood	unlikely	Possible		Likely
Impact Magnitude	Negligible		Small	MediumLarge
Receptor Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate .			

6.8.2 Waste Generation

6.8.2.1 Sources

- Wastes likely to be generated during routine operations are dielectric fluids, clearing agents and solvents etc.
- Repair and maintenance of underground cables and associated utilities will lead to generation of hazardous wastes as used oils.
- Wastewater from WTGs cleaning.
- Hazardous waste generated from operation and maintenance of Wind Power plants is limited to small quantities of waste oil from use of lubricant oil and transformer oil;
- Waste from defunct / damaged wind turbine spare parts will also be generated.
- Domestic wastewater and solid waste

6.8.2.2 Receptor

Improper disposal and maintenance of waste may lead to contamination of soil, surface and groundwater environment, which could result in indirect impacts to humans, flora, and fauna. Receptor sensitivity is medium.

6.8.2.3 Impact Assessment

Once the plant is commissioned there will be limited waste generation, however different hazardous and non-hazardous waste will be generated from WTGs cleaning, used oil from substation, broken WTGs. These wastes typically would be put in containers, characterized and labeled, possibly stored briefly, and transported by a licensed hauler to an appropriate permitted off-site disposal facility as a standard practice.

Hazardous waste generated from operation and maintenance of WTGs is limited to small quantities of waste oil from the use of lubricant oil for gearbox and transformer oil. Improper disposal of hazardous waste can lead to contamination of soil and groundwater, which could result in indirect impacts to humans, flora, and fauna.

Operations and maintenance of the WTGs are not expected to require hazardous materials to be present and used on Site or to generate hazardous waste. WTGs, and inverter/transformer enclosures will not produce waste during operation.

Once the WTGs have reached the end of their life cycle, the manufacturer of the WTGs will collect and recycle the WTGs parts and recover any hazardous substances in the WTGs. This provision forms part of the supply agreement between the proponent and the selected Turbines manufacturer.

The WTGs will possibly be cleaned once in five years to remove dust accumulated on the surfaces of the turbines tower, nacelle and blades during the operational phase of the project. The water used for cleaning will not contain any harmful chemicals or additives and will not be heated. Therefore, the water is not regarded as wastewater and the water will be allowed to percolate into the soil. As the impact magnitude is **medium** from waste and effluent generation from operation phase the significance of impact assessed as **moderate**.

Table 111: summary of impact of waste generation during operation phase

Impact	Impact of waste generation				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project site				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate .				

6.8.3 Impact on Water Resources Quantity and Quality

6.8.3.1 Sources of Impact

The impacts of the proposed project on water environment are assessed with respect to following:

- Water use for WTGs cleaning.
- Water Consumption for domestic use.
- Possibility of groundwater level reduction due to compacted soil and covered by WTGs.
- Surface water pollution due to the surface runoff from the project site
- Surface and groundwater pollution due to the accidental leakage and spills of oil

6.8.3.2 Receptor

Surface water from the localities close to the project and groundwater might be polluted. Water resources from localities around may face shortage due to quantities of water for WTGs cleaning. Receptor sensitivity might be assessed as **low to medium**.

6.8.3.3 Impact Assessment

6.8.3.3.1 Water Availability

During the operation phase, the water requirement will be for domestic as well for cleaning of turbines. Turbines cleaning needs to be carried out periodically (1 times per 5 years) to remove dust, bird dropping etc. During operation of the whole project, approximately 150 persons will work on the project site, and they will consume approximately 150-liter water per person per day (according to statics in KSA). The water has to be provided by tankers. There is both surface and ground water source to meet up the water requirement during

Operation water to be provided from the close localities. As there is water scarcity of water in the region, availability of water in the project site would be a major problem sensitivity of This situation will put more stress on water availability in close localities receptor is assessed to be high. Impact magnitude will be assessed **small to medium** considering the nature of non-water consuming of such facilities. Therefore, impact significance due to water consumption and availability during operation phase has been assessed as **minor to moderate**.

Table 112: summary of impact on water availability during operation phase

Impact	Impact of on water availability				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project site				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate .				

6.8.3.3.2 Impact on Water Quality

Rare Run-off from the plant site may carry waste oil from plant area to the nearest drainage system. Due to proposed hard standing areas (lay down areas, building foundations, compacted gravel roads), compacted soil (rows between arrays) and WTGs covering large parts of the Site, possible recharge to groundwater from rainfall is expected to be reduced on the site. Sewage would be generated from substation and Control/SCADA building, and this will be of negligible quantity.

Based on the above possibility of impact, the impact has been assessed as **minor to negligible** due to the plant operation.

Table 113: summary of impact on water quality during operation phase

Impact	Impact of on water quality				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project site				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.8.4 Impact on Air Quality

6.8.4.1 Sources of Impact

The impacts of the proposed project on air quality are assessed with respect to following:

- Maintenance of vehicles and machinery used in the site.
- Transportation during operation and maintenance of the power plant

6.8.4.2 Receptor

As the project is a renewable and clean energy development project, the operation will be largely free from air emissions. The only limited vehicle will move through the access road and within the project site for maintenance activities so dust and emission will be generated. There are no major settlements close to the project site. Thus, receptor sensitivity is assessed to be **low**.

6.8.4.3 Impact Assessment

No emissions are expected to be released during the operation phase, due to the fact that Wind power plants do not release greenhouse gases or any toxic pollutants during their operation as Wind Power plants do not involve combustion processes. Dust will be generated during the movement of the vehicle during maintenance of power plant which is very limited scale. Limited exhaust will be emitted from the vehicle during the operation phase. impact magnitude is then assessed to be **small to medium**. The impact significance of dust and emissions generated during the operation phase is considered as **minor to negligible**.

Table 114: summary of impact on air quality during Operation and maintenance phase

Impact	Impact on air quality				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project site				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.8.5 Impact on Ambient Noise Levels

6.8.5.1 Sources of Impact

Noise will be generated from the following activities during operation phase:

- Vehicular movement
- Noise from inverters and transformers
- Repair and Maintenance Works of WTGs
- Noise from spinning of the Wind turbines

6.8.5.2 Receptor

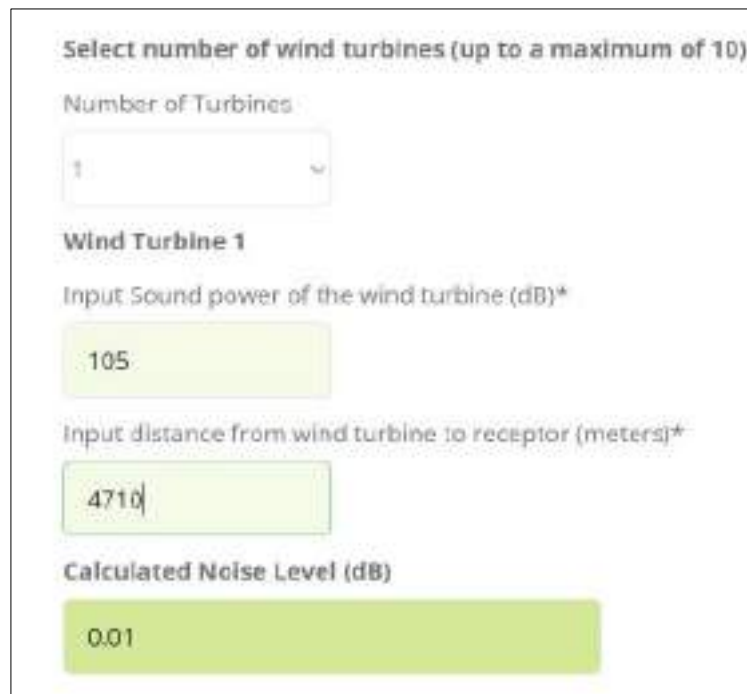
No major noise will be generated from the Wind Power plant. And there is no close settlement to the plant. People living along the access roads and traffic will not feel discomfort from traffic level as in construction phase. intensity of movement of vehicle from and to the project will be extended in time and not felt by settlement. So, the receptor sensitivity will be assessed as **low** during the operation and maintenance phase.

6.8.5.3 Impact Assessment

6.8.5.3.1 Wind turbine spinning noise

Wind turbines produce noise during operation from mechanical and dynamic sources. Mechanical noise is mainly confined to the machinery in the turbine shaft (gearbox, alternator, auxiliary equipment, etc.) while aerodynamic noise is generated from the movement of air around the turbine blades and the tower. The noise from the wind turbines can be evaluated and whether

there is an impact of this noise on the residential communities adjacent to the project. This is done by setting the worst scenario when the turbines are operating at the maximum capacity with a wind speed of 10 m/sec and above. According to the characteristics of the turbine adopted in the project, the maximum noise level emitted by it is 105 dB. Calculating noise level according to the Method of WKC Environmental Engineering Experts website, the noise is reduced and completely absent when moving away from the turbine by about 4710 meters. As shown in the figure below.



Select number of wind turbines (up to a maximum of 10)	
Number of Turbines	1
Wind Turbine 1	
Input Sound power of the wind turbine (dB)*	105
Input distance from wind turbine to receptor (meters)*	4710
Calculated Noise Level (dB)	0.01

Figure 49: Wind turbine noise level calculation

Thus, the impact of noise generated by the turbines from the nearest residential communities to the station will be non-existent. Since the nearest residential community is about 13 km away from the nearest turbine.

6.8.5.3.2 Noise from on-site equipment

On-site equipment such as stations and transformers are also a source of noise during operation. Given the limited amount of mechanical equipment used in the daily operation of the project, these effects are not expected to be significant, but the transformer and inverter units are expected to emit a low noise level of 65-70 dB. The main substations connected to the substation will also produce noise during operation. The absence of sensitive receivers near the project site and the low level of operational noise means that there are no negative impacts to be expected from noise during the operation phase.

During the operation phase of the project, the limited vehicle will move on the access road and within the project site for maintenance activities as a result dust generation and exhaust emission will be a negligible amount. Noise emission will be limited as well. Overall Impact significance is assessed to be **minor to negligible**.

Table 115: summary of impact on ambient noise during Operation and maintenance phase

Impact	Impact ambient noise				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project site				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.8.6 Impact on Ecology and biodiversity

The only impacts anticipated during the operation phase are related to improper management of the site as discussed earlier. This could include improper conduct and housekeeping practices by workers (i.e., hunting of animals, discharge of hazardous waste to land, etc.).

The potential impacts on biodiversity would of a long-term duration throughout the operation phase of the Project. Such impacts are of negative nature and of a low magnitude. However, as the site is considered of low ecological significance, the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be of **minor** significance.

Table 116: summary of impact on ecology and biodiversity during operation phase

Impact	Impact on ecology and biodiversity				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.8.7 Landscape and Visual Impact

6.8.7.1 Sources of Impact

As total of 324 WTGs will be set up in the proposed project area. the original landscape is highly modified as it will be covered by the turbines so the presence of a large area of WTGs is expected to constitute a risk of shadow flicker . Besides this, lighting in the power plant area and building structure also sources of visual impact. Shadow flicker from the WTGs may create a limited visual impact to passing people.

6.8.7.2 Receptor

The landscape of the project area is fallow land with a poor vegetation cover far from settlements. Installation of wind power plant will modify its original landscape.

Shadow flicker from the WTGs may affect people passing around. Sensitivity of receptors is assessed to be **low**.

6.8.7.3 Impact Assessment

The visual impacts will be perceived by two types of receptors, namely:

- Receptors located at a fixed point, i.e. dwellings on the Site and surrounding areas; and
- Receptors who will temporarily come into contact with the wind farm, such as passing people around the area.

WTGs will not cause any visual impact on the settlement area. so, the visual impact due to the Wind Power plant considering without mitigation measures has been assessed as **minor to negligible**.

Table 117: summary of impact landscape and visual during Operation and maintenance phase

Impact	Impact on land scape and visual				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project site				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.8.8 Occupational Health and Safety

6.8.8.1 Sources of Impact

There are many hazards associated with a Wind power plant if sufficient precautions are not taken during the operation stages. The impact origins are in the following sectors:

- Leaching of materials from broken or fire damaged WTGs
- Vehicle accidents, replacement of components/parts
- Emergency Fire Hazard
- Electrocution of workers
- Electromagnetic radiation from WTGs
- Working at height for WTGs replacement or maintenance

6.8.8.2 Receptor

The main receptors are workers of the power plant and nearby passing people who are living close to the project site. Receptor sensitivity is assessed as **medium**.

6.8.8.3 Impact Assessment

Leaching of materials from broken or fire damaged WTGs and accessories: the potential for chemical releases appears to be small since the chemicals are present in the sealed WTGs when completed installations of turbines for power generation. Releases are likely to occur only due to fires or other unusual accidents.

Vehicle accidents, replacement of components/parts: The potential occupational safety and health risks include injuries to workers from routine monitoring and maintenance activities (vehicle accidents, replacement of components/parts, etc.) and emergencies such as equipment malfunction, fires, etc.

Emergency Fire Hazard: Since this is a Wind power plant, the plant has always some risks of fire hazards. Electrical equipment is the main source of a potential fire hazard. In the event of fire catching in wind turbine, it is theoretically possible for hazardous fumes to be released and inhalation of these fumes could pose a risk to human health. However, researchers do not generally believe these risks to be substantial given the short- duration of fires and the relatively high melting point of the materials present in the WTGs. Moreover, the risk of fire at ground-mounted installations is remote because of the precautions are taken during site preparation including the removal of fuels and the lack of burnable materials contained in a WTGs.

Electrocution of Workers: Risk of electrocution of workers during performing duties in a power plant is always present. Faulty electrical equipment, electric short circuits, exposed electrical wires may be the chief sources of electrocution. Damaged WTGs spare parts with exposed high voltage conductor also present high risk of electrocution.

Electromagnetic radiation from WTGs: The strength of electromagnetic fields produced by wind power systems do not approach levels considered harmful to human health established by the International Commission on Non-Ionizing Radiation Protection. Moreover, the small electromagnetic fields produced by wind turbine rapidly diminish with distance and would be indistinguishable from normal background levels within several yards.

Working at height for maintenance: Periodic maintenance will be required for proper functioning of WTGs. Maintenance worker may fall down from the height during the maintenance work. Beside this, there is a possibility of electrocution during the maintenance work WTGs.

As the abovementioned impact may happen during the operation phase but the probability of the impact occurrence is **Medium**. The impact may cause serious damage if the proper mitigation measures do not take properly. So, the impact on health and safety during operation phase has been assessed as **minor to moderate**.

Table 118: summary of impact on occupational health and safety during operation phase

Impact	Impact on occupational health and safety				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate .				

6.8.9 Traffic and Transport

6.8.9.1 Sources of Impact

During the operation phase, only limited person will be involved with the power plant. Minimum transportation will be required for maintenance of the power plant.

6.8.9.2 Receptor

Limited traffic will be run on the access Road. Receptor sensitivity is then **low**

6.8.9.3 Impact Assessment

A limited number of people will be employed permanently at the power plant during the operation phase of the Wind power facility and these employees will reside in on-site accommodation. Infrequent deliveries of replacement parts may be made during the lifespan of the Wind power facility. Traffic impacts associated with the operation of the facility will be minimal and therefore traffic impacts associated with the operation are not considered any further. The impact due to the traffic movement during operation phase will be **negligible**.

Table 119: summary of impact on traffic and transport during operation phase

Impact	Impact on traffic and transport				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Negligible .				

6.8.10 Impact on Climate Change

The project is based on the power generation through Wind Technology. The Wind technology is environment-friendly in terms of GHGs emission. Levels of carbon dioxide (CO₂) and other greenhouse gases (GHG) in the atmosphere have increased dramatically in the past few decades. wind energy is a Renewable resource available with the great potential to significantly reduce GHG emissions. The technology of electricity generation from Wind Power Plant is environment friendly as it does not use any fossil fuel. It thereby reduces the greenhouse gas emissions associated with fossil fuel-based electricity generation system. The availability and reliability of Wind Power depend largely on current and future climate conditions, which may vary in the context of climate change.

The comparison of the GHGs emission caused by Wind Power plant with the GHGs emission that would have been caused by fossil fuel burned to make the same amount of electricity has been made. Thus, the purpose of the project activity is to generate power from zero emissions Wind power project and thereby reduce the emissions associated with the grid.

The proposed power plant is based on wind power technology which generates electricity using wind energy which depends upon wind speed and availability in the area. It is defined by the Global Horizontal Irradiance (GHI) of the area, wherein shortwave radiations received by the surface at a high temperature get absorbed and individual electrons in bonds move into a higher energy level. This absorption of energy does not cause any change in temperature of the area. It is also very well understood that there can be an increase in temperature, which will be confined only to the site.

Climate change is a burning issue now a day. The project will help in reduction of GHG emission with the use of environment-friendly technology of power generation. So, it would be a long-term beneficial impact of the project.

6.8.11 Impact on Employment

The operation and maintenance phase activities of the project including maintenance and cleaning of WTGs. Maintenance of structures and replacement of spare parts of WTGs, Irrigation of green spaces, cleaning of service building ..etc. will involve skilled, semi-skilled and unskilled workers, who are likely to be recruited from the local community.

The project is also likely to create a number of indirect economic opportunities in terms hiring tractors, trucks.... etc. As the project development will generate the employment opportunity so it is assessed as the **positive** impact.

6.8.12 Impact on shadow flicker

Shadow flicker occurs when the sun passes behind a wind turbine and casts a shadow hundreds of meters from the turbine's location. As the blades rotate, the shadows pass over the same point causing an effect known as "shadow flicker".

Shadow flicker only occur under specific environmental conditions which include the position and altitude of the sun, wind speed, direction, cloudiness, and the position of the turbine relative to the sensitive receptors.

Excessive shadow flicker can be a nuisance and can create a disturbing indoor environment for occupants of buildings close to the project, especially the windows of buildings facing the turbine directly without obstructions in sight such as trees, hills, etc.).

The Queensland Wind Power Plant Planning Guide indicates that shadow flashes typically occur at a distance of about 10 times the rotor diameter of a wind turbine. At distances exceeding 10 times this diameter shadow flicker effects cannot be detected. Beyond this distance, the shadows are spread out such that the contrast in light levels is not sufficient cause for alarm. This manual also states that the first step in performing a shadow flicker assessment is to determine the extent of the shadows produced by the turbines and to suggest a distance equal to 265 m from the extreme of the blade, the thickest part of the blade, as an appropriate limit. This limit corresponds to about 800 m to 1,325 m for modern wind turbines, which usually have this blade length ranging from 3 m to 5 m. The rotor being considered for the current project is 170 metres, and therefore shadow flash effects are likely to occur within a 1,659-meter radius circle.

The IFC guidelines for wind energy, environment, health, and safety for wind plants state that if receptors are present, commercially available shadow flash modelling software can be used to determine the distance to potential shadow flash effects.

The distance between the last turbine from the wind station and the nearest residential community from the planned wind station is about 13 km. Therefore, these effects are considered unimportant, and it is not necessary to model this phenomenon to accurately determine its impact. The impact is considered with **negligible** significance.

6.9 Impact Assessment in Decommissioning Phase

6.9.1 Impact on Soil Environment

The decommissioning activities will cause following impacts on soil:

- Soil compaction due to the increased vehicular and workforce movement, dismantling and storage of plant components on the adjacent land, removal of internal electric lines/ poles etc.
- Waste will be generated in form of dismantled plant components and demolition debris from plant foundations, storage yard and substation complex. Electric components such as transformers, insulators, wires will be generated. The waste will be mainly of inert nature.
- Depending on the type used, Spare parts of WTGs may contain toxic substances. If any WTGs part is damaged during the dismantling of the facility, these toxins are likely to spill and leach into the soil and contaminate it.

Soil contamination during decommissioning phase may occur due to leakage from machinery and transportation vehicles and during collection of remaining oil/ lubricants in the plant.

Receptor sensitivity, based upon the context presented above, is assessed to be **low**.

Removal of grounded structures and demolition during decommissioning phase may affect the top layers of the soil and loss of topsoil quality but the effects can be reversed over time. Also, as the plant is spread over 320 km², number of labors required during the decommissioning phase is assumed to be large. Hence, generation of domestic waste will be a lot, especially at the labor camps. Thus, the Impact magnitude has been assessed to be **medium**.

The overall impact significance is assessed to be **minor**.

Table 120: summary of impact soil environment during decommissioning phase

Impact	Impact on soil environment				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site				
Impact frequency	During decommissioning phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.9.2 Impact on Water Environment

Water during the decommissioning phase will be consumed by laborers and will be required for civil work. The water demand could be met through procurement of water tankers. Potential contamination of groundwater /surface water resources resulting from improper management of sewage and accidental spills/leaks at the storage areas is **low**.

The overall impact significance is assessed to be **minor**.

Table 121: summary of impact soil environment during decommissioning phase

Impact	Impact on water environment				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site				
Impact frequency	During decommissioning phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.9.3 Impact on Air Quality

Air quality will largely get impacted from the following sources during the decommissioning phase:

- Fugitive dust emissions from site excavation work, to remove structure and restore the land to its original state.
- Vehicular emissions due to traffic movement on site and on access roads.
- Exhaust emissions from heavy machineries
- The WTGs compounds if not handled or disposed of properly during the decommissioning phase, any toxic substances contained within them are likely to escape into the surrounding air creating serious environmental and public health risks.

The biggest source of emissions in the decommissioning phase is the fugitive dust emissions from demolition activities. the impact magnitude has been assessed as **small**.

The impact significance for air quality in the decommissioning phase is assessed as **negligible**.

Table 122: summary of impact on air quality during decommissioning phase

Impact	Impact on traffic and transport				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlements around the project				
Impact frequency	During operation and maintenance phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Negligible .				

6.9.4 Impact on Ambient Noise

During decommissioning phase of the project, noise will generate from movement of vehicles carrying dismantled structure and equipment.

The area is free from any industrial activity or human settlement except some temporary herders and farmers. the receptor sensitivity is assessed to be **low to medium**.

Impact magnitude is considered to be **small** considering the decommissioning period to last for small duration.

The overall impact significance is envisaged to be **negligible to minor**.

Table 123: summary of impact on ambient noise during decommissioning phase

Impact	Impact on ambient noise				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site				
Impact frequency	During decommissioning phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.9.5 impact on occupational health and safety

The decommissioning of the Wind Power plant will involve a range of activities that could potentially be unsafe to workers without mitigation measures.

6.9.5.1 Impact source

The sources of impact on the health and safety of the Project construction workforce are listed below.

- Accidents and injuries associated with the operation of heavy machinery and other construction activities; and
- Health impacts associated with environmental conditions and changes in environmental quality, arising from emissions of air, water pollution and noise generation from decommissioning as well as from storage and handling of waste, particularly hazardous waste.
- Loading activities of dismantled materials
- Working at height, working with rotating machinery and falling objects

6.9.5.2 Receptor sensitivity

Workers will be exposed to occupational health and safety impacts arising from dismantling of Wind power plant. The decommissioning phase will last a short period of time

Sensitivity of receptor is assessed as **medium**.

6.9.5.3 Impact assessment

During dismantling works, physical injury maybe results from working with rotary machines, loading dismantled objects, and other occupational hazards. Overexertion injuries and illness are potentially the most common health hazards associated with construction activities. Further, there is potential for slips and fall on the same elevation associated with poor housekeeping, such as excessive waste debris, loose construction material, liquid spills and uncontrolled use of electrical cords and ropes on the ground which results in injuries and time loss during construction.

Hazards associated with fall of dismantled objects or tools, as well as the collapse of constructed slabs, walls and roofs can result in injury to head, eyes, and extremities. Transportation of dismantled structures and object and movement of vehicles are associated with road accidents and related hazards, which can lead to injuries and fatalities.

Therefore, there will be potential impacts on worker's health and safety due to exposure to risks through dismantling activities that lead to accidents causing injuries and death. The most frequent risks cause of accidental death and injury are:

6.9.5.3.1 Safety Risks

- Tripping due to uneven surfaces, obstacles, trailing cables.
- Falling during working at height due to fall from fragile surfaces, roof edges, and ladders.
- Fire due to hot works, smoking, failure in electrical installations.
- Mobile plant and vehicles; and
- Electrical shocks.

6.9.5.3.2 Health Risks

- Manual handling and musculoskeletal disorders: typical dismantling activities that can cause injury such as lifting, lowering, pushing, pulling and carrying.
- Hand-arm vibration: people work with hand-held or hand-guided power- tools and machines, such as concrete breakers, grinders and disc cutters, hammer drills, chipping hammers, chainsaws, scrabbles and needle guns.
- Temporary or permanent hearing loss which usually comes from noise generated from machinery used for cutting and dismantling structures and from compressors etc.
- Heat stress and working at high temperatures.

These risks could create long-term impacts to the health and safety of the dismantling workforce and therefore the impact magnitude is assessed to be **medium** without mitigation measures. So,

the impact significance on occupational health and safety during decommissioning phase has been assessed as **Moderate** without taking mitigation measures.

Table 124: summary of impact on occupational health and safety during decommissioning phase

Impact	Impact on occupational health and safety				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant				
Impact frequency	During construction phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate .				

6.9.6 Impact on Employment and community

The major social impacts associated with the decommissioning phase are linked to the loss of jobs and associated income and issues results from this situation when workers asked to leave. This has implications for the households who are directly affected, including their families. However, the impacts are likely to be limited due to relatively small number of permanent employees (mainly security guards) who will be affected. Other associated impacts would be that improper disposal of construction waste and debris from deconstruction of storage area, etc. will lead to contamination of soil and discontentment with the immediate surrounding settlements. The receptor sensitivity is assessed to be **low**.

Impact magnitude is considered to be **small to medium** considering the decommissioning period to last for small duration.

The overall impact significance is envisaged to be **Minor**.

Table 125: summary of impact on employment and community during decommissioning phase

Impact	Impact on employment and community				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Wind Power plant site /settlement around site project				
Impact frequency	During decommissioning phase				
Impact Likelihood	unlikely	Possible		Likely	
Impact Magnitude	Negligible		Small	Medium	Large
Receptor Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor .				

6.10 Cumulative Impact Assessment

During site visit it was observed that the project falls in an area with no other project or existing facilities that could interfere with the Wind Power plant project. Then no cumulative impacts could be mentioned.

6.11 Summary of potential impacts

The impacts identified in this chapter in each project phase are recapitulated in the following table.

Table 126: summary of the project impacts

Potential Impact	Impact nature	Impact type	Impact duration	Impact extent	Impact frequency	Impact likelihood	Receptor sensitivity	Impact magnitude	Impact Significance
A- CONSTRUCTION PHASE									
Impact on Land Use	Negative	direct	Long - term	local	Construction phase	Likely	low	medium	Minor
Impact on topography and drainage	Negative	direct	Long term	local	Construction phase	Likely	low	medium	Minor
Impact on soil contamination									
· Soil contamination due to waste generation	Negative	direct	Long-term	Local/regional	Construction phase	Likely	low	medium	Minor
· Soil contamination due to leaks /spills	Negative	direct	Long - term	local	Construction phase	Likely	low	medium	Minor

Potential Impact	Impact nature	Impact type	Impact duration	Impact extent	Impact frequency	Impact likelihood	Receptor sensitivity	Impact magnitude	Impact Significance
Impact on soil erosion and compaction	Negative	direct	Long - term	local	Construction phase	Likely	low	Medium	Minor
Impact on surface water availability	Negative	direct	Short - term	regional	Construction phase	Likely	high	small	Moderate
Impact on ground water availability	Negative	direct	Short - term	Local/regional	Construction phase	Likely	low	Negligible	Negligible
Impact on surface water quality									
Contaminant ion by wastewater	Negative	direct	Long-term	local	Construction phase	Likely	Medium	small	Minor
Contaminant ion by spills /leaks	Negative	direct	Long-term	local	Construction phase	Likely	Medium	small	minor
Contaminant ion by loads sediments	Negative	direct	Long-term	regional	Construction phase	Likely	Medium	small	minor
Impact on groundwater quality	Negative	direct	Long-term	Local/regional	Construction phase	Likely	Medium	small	Minor
Impact on air quality									
Dust from construction	Negative	direct	Short - term	local	Construction phase	Likely	low	Medium	Minor
Exhaust/fugitive emission	Negative	direct	Short-term	local	Construction phase	Likely	low	Medium	Minor
Odors	Negative	direct	Short - term	local	Construction phase	Likely	low	Medium	Minor
Impact on ambient noise	Negative	direct	Short - term	local	Construction phase	Likely	low	Medium	minor
Impact on traffic and transport	Negative	direct	Short - term	regional	Construction phase	Likely	Medium	Medium	Moderate
Impacts on ecology and biodiversity	Negative	direct	Short - term	local	Construction phase	Likely	Low	Medium	minor
Impact on occupational health and safety	Negative	direct	Short - term	local	Construction phase	Likely	Medium	Medium	Moderate
Socio-economic impacts									
Impact on community health and safety	Negative	direct	Long-term	regional	Construction phase	Likely	Medium	small	Minor
Impact on employment	Positive	direct	Short - term	regional	Construction phase	Likely	--	--	Positive
Impacts from migrant workers (social impacts, spreading of infectious disease.)	Negative	direct	Short-term	regional	Construction phase	Likely	Medium	small	Minor
Archeology and cultural heritage	No impact								No Impact
B- OPERATIONAL AND MAINTENANCE PHASE									
Impact on Land and Soil Environment									
Improper waste disposal	Negative	Direct	Long-term	Local/regional	Operation phase	likely	medium	Medium	Moderate
Soil contamination due to accidental spills leaks	negative	Direct	Long-term	local	operation phase	Likely	medium	Medium	Moderate
Waste generation	Negative	Direct	Long-term	Local/regional	operation phase	Likely	medium	Medium	Moderate
Impacts on water quality and quantity									

Potential Impact	Impact nature	Impact type	Impact duration	Impact extent	Impact frequency	Impact likelihood	Receptor sensitivity	Impact magnitude	Impact Significance
Water availability	Negative	Direct	Long-term	regional	operation phase	Likely	medium	medium	moderate
Water quality	Negative	Direct	Long-term	Local/regional	operation phase	Likely	Medium	small	minor
Air quality	Negative	Direct	Long-term	local	operation phase	Likely	Low	medium	minor
Impact on Ambient Noise Levels	Negative	Direct	Long-term	local	operation phase	Likely	Low	medium	minor
Impact on Ecology and biodiversity	Negative	Direct	Long-term	local	operation phase	Likely	Low	medium	minor
Landscape and Visual Impact	Negative	Direct	Long-term	Local/regional	operation phase	Likely	Low	medium	minor
Occupational Health and Safety	Negative	Direct	Long-term	local	operation phase	Likely	Medium	medium	Moderate
Traffic and transport	Negative	Direct	Long-term	regional	operation phase	Likely	Low	small	Negligible
Impact on climate change	Positive	Direct	Long-term	regional	operation phase	Likely	--		Positive
Impact on employment	Positive	Direct	Long-term	regional	operation phase	Likely	--		positive
C- DECOMMISSIONING PHASE									
Impact on soil environment	Negative	Direct	Short-term	Local/regional	Decommissioning phase	Likely	low	Medium	minor
Impact on Water Environment	Negative	Direct	Short-term	Local/regional	Decommissioning phase	Likely	low	Medium	minor
Impact on air quality	Negative	Direct	Short-term	local	Decommissioning phase	Likely	low	Small	Negligible
Impact on ambient noise	Negative	Direct	Short-term	local	Decommissioning phase	Likely	Medium	small	minor
Impact on employment and community	Negative	Direct	Short-term	regional	Decommissioning phase	Likely	Medium	Small	Minor
Impact on occupational health and safety	Negative	Direct	Short-term	local	Decommissioning phase	Likely	Medium	Medium	Moderate

7. MITIGATION MEASURES

7.1 Identification and description of mitigation measures

Preventive measures are more effective when applied at an early stage of project (planning).

During first stages, the environmental component has a key factor in the design of the elements of a project. Sustainable design can enable to avoid risks and impacts, reducing costs and improving benefits.

The overall objective of the environmental infrastructure design criteria has been to ensure that the project will be developed in an environmentally sound and sustainable manner ensuing that all negative effects are mitigated as best as practical and positive impacts are enhanced.

Mitigation hierarchy has been considered during the design of the infrastructure: Avoid, Minimize / Reduce, Mitigate, and Compensate; that is:

- Anticipate and avoid risks and impacts.
- Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels.
- Once risks and impacts have been minimized or reduced, mitigate such risks and impacts.
- Compensate where significant impacts occur.

Table 127 : Mitigation hierarchy in the design of the infrastructure

Preference Order	Mitigation Hierarchy
1	Avoid
2	Minimize/Reduce
3	Mitigate
4	Compensate

Since the first stage of the project, the following measures have been considered to avoid, to reduce or to mitigate impacts foreseen:

Land Use and Local People

- Minimize land take as far as possible.
- Construction camps and ancillary facilities have been located at areas which are acceptable from environment, cultural and social point of view.

Design for Prevention and Minimization

- Provisions to preserve the operation of current facilities in enough quantity. Coordination with the utility company. Preliminary study of Existing Utilities and Urban Networks data collection and analysis.
- Ensure that the Project and all associate activities will cause the least environmental/ cultural/ social impacts:
- Minimize loss of trees/vegetation.
- Protect trees by fencing during construction phase (marking out and individual protection).
- Provision of adequate and timely tree transplanting and replacement.
- Minimize noise impacts to sensitive receptors.
- Minimize impacts on landscape and restoration of altered areas.
- Reuse (if suitable) of excavation spoils.
- Identification of a suitable disposal location. Selection of authorized landfill for spoils. Designation of suitable transport routes and schedule for spoil truck movements to minimize traffic disruption/congestions.
- Mitigation measures for avoiding traffic congestion and access problems in Road Transport

Water Conservation

- Ensure maximum water efficiency.
- Stormwater stored and reuse
- Grey water recycling and reuse network.
- Protect water quality.
- Avoid habitats emergency for insects

Energy Efficiency and Renewable Energy

- Energy Efficiency in Buildings to achieve the goal of reducing carbon footprint and electricity cost.
- Material planning for efficient maintenance in Buildings and Energy Saving, reducing the consumption of energy during operation. Increase maintenance efficiency by zoning the Buildings.
- Proper ventilation in Buildings avoiding greenhouse effect.

Noise

- Fulfilment of legal framework and standards.

- Noise Control Plan.
- Good construction practices about noise mitigation measures will reduce significant noise levels:
- During construction phase, the contractor shall employ only approved vehicles and machinery. All the vehicles and machinery must work properly avoiding malfunctioning that may increase noise levels. Equipment will be serviced regularly and operated as per manufacturer's specifications.
- Night works should be avoided to reduce noise nuisance.
- Truck drivers and equipment operators shall minimize the use of horns.
- All construction equipment and vehicles shall be well maintained and shall be fitted with appropriate noise suppression equipment consistent with applicable national noise standards.
- Standard sound reduction devices such as silencers or mufflers will be installed on construction equipment.
- Whenever possible, completely enclose noisy equipment which can reduce noise level by 15-25 dB(A) and restrict the use of noisy equipment.
- Speed limits will be imposed on construction vehicles to minimize noise emission.
- If some works & activities generate high noise levels in sensitive areas, the contractor shall install temporary barriers.

Air Quality

- Dust Control Plan
- Good construction practices about air quality mitigation will reduce significant impacts:
- To reduce air pollutant emissions from point and mobile sources during construction, it will be used cleaner fuels such as ultra-low sulphur fuels. The construction contractor will also ensure that fuels will be burned more efficiently by using machinery and vehicles according to manufacturer's specifications. In addition, a preventive and regular maintenance program will be undertaken by the construction contractor to ensure that machinery and vehicles are in good condition throughout the duration of the project construction and meet national emission standards.
- Burning of wastes generated at the construction sites shall be strictly prohibited. No bonfires.
- Dust generating materials stockpiled and transported by road vehicles will be covered with suitable sheets or dampens with water to prevent dispersal of particulates.

- Paving or regular dampening with water on haul roads.
- Setting appropriate speed limits onsite.
- Provision of wheel washing bay at project site exits to prevent materials offsite.

Waste and Wastewater

- Waste and Wastewater Management Plan.
- The waste during construction phase will be managed in a manner that will be safe and without risks to the health of workers, the community, or the environment.
- Consideration of sustainable options such as renewable, reusable or recyclable materials and implementation of waste management options integrating international best practices will reduce waste generation thereby minimizing the load on existing waste disposal facilities. In addition, waste will be segregated at source to readily facilitate sorting of waste when transferred to a designated central waste holding area or directly to a waste recycling plant, to ensure recycling and reuse of materials.
- Regarding wastes generated during construction, the mitigation measures for the prevention, mitigation and remediation of any significant adverse environmental impact will be:
- Measures provided for in the law and other regulations, standards and deadlines for their enforcement.
- Measures to reduce the amount of waste generated and minimize the resources needed to do the job.
- Measures that can contribute to the prevention or mitigation of harmful environmental effects. Prevention is financially advantageous as it reduces the purchase of construction materials and obviates the need to remove wastes from site. Purchase of cleaning materials that will minimize damage to the environment.
- Plans and technical environmental protection solutions (recycling, treatment and disposal of waste substances and other).
- Measures that will be undertaken in case of accident.
- Impacts from hazardous materials will be managed through appropriate management system including disposal through approved environmental service providers to transport and dispose of the hazardous wastes.
- Emergency Action Plan to potential situations of risk.
- Treatment of contaminated water before discharge in accordance with wastewater standards. Discharge permit.

Landscape Integration and Visual Impact

- The design for the buildings shall adopt universal design principles, including improved facilities for woman, the elderly persons with disabilities. All the detail architectural designs in Buildings shall be prepared in accordance with local design. Appropriate color treatment of the buildings shall be used to help the structures fit in with the landscape. The facades on the structures shall be designed to be sensitive to the local landscape character. Materials aesthetically pleasant and Harmony with surrounded environments.
- Use of environmentally friendly materials
- Structures will be designed in a manner sensitive to the local landscape character within the area including the use of neutral colors and materials.
- Only lighting the areas that are required and directing lighting away from visual receptors.
- Planting, as part of mitigation measures, will increase the ability of the landscape to accommodate development. Different criteria will be used to select the most suitable species to achieve a balanced and sustainable plantation scheme. The selected species will have the purpose of contributing for the integration of the new buildings and structures with the surrounding environment using shapes and color contrasts to create enjoyable spaces with a strong local identity.

The Project will include these considerations about landscape mitigation measures during construction phase:

- Minimization of working areas as much as possible.
- All earthworks design shall minimal visual impact. The finished surfaces of earthworks shall be protected against erosion.
- Careful consideration of the form and finish of structures so they fit in with existing landscape.
- Disposal of excavated unacceptable material shall be minimized, where possible.
- Restriction of stockpiling heights. Stockpile areas will be fenced.
- Dust control.
- Tidy storage of materials and machinery.
- Making good all work sites at the end of the construction period.
- Appropriate storage and reuse of topsoil for final landscaping.

7.2 Mitigation measures in construction phase

7.2.1 mitigation measures for impact on land use

The actual area of land use impact would be limited to some grazing lands in immediate vicinity of the Wind Power plant. The overall impact on land use is considered negligible, however the following mitigation measures should be implemented:

- the After-construction work, any land taken for a temporary basis for storage of material will be restored to their original form.
- Existing roads widened and developed for access to the project site with the exception of a small connection from the Mekkah-Riyadh highway to the plant site.
- Construction activities should be restricted to designated area.
- The land use in and around permanent project facilities should not be disturbed.
- The construction activities will be restricted within the boundary of the proposed plant and will not alter the land use of the adjacent areas.
- Proponent should take tree plantation program whereas possible in the plant boundary or along the access roadside.
- Waste should not be allowed to litter in and around the project area.
- On completion of construction activities, land used for temporary facilities will be restored to the extent possible.
- The land should be restored back to the original state to the extent possible after completion of the life cycle of the project and in case there are plans not to continue further at the site.

The impact on land use will have a high intensity within the project site for a permanent duration which will result in an overall minor impact without mitigation. with proper implementation of suggested mitigation measures, the overall impact will be **negligible**.

7.2.2 mitigation measures for land use for topography and drainage

The following measure should be implemented to mitigate the change topography and drainage pattern:

- The EPC contractor will be instructed to avoid any unnecessary changes in the topography.
- Detail hydrology study should be carried out.
- Appropriate number of cross drainage channels should be provided during access road construction to maintain flow in existing natural channels.
- Keep all natural channels to the extent possible at their original state.

- Design structures considering the natural functioning of the of drainage channels.

The impact on the topography and drainage pattern will have medium intensity with locally extent for a long duration which will result in an overall minor to medium impact without mitigation. However, with proper implementation of suggested mitigation the impact will be reduced to **negligible**.

7.2.3 mitigation measures for soil contamination

The following mitigation measures will be taken to mitigate soil contamination.

7.2.3.1 Leaks and spills

The following measure will be implemented to mitigate the Soil contamination by leaks and spills.

- Fuel, lubricating oil, and used oil storage areas will be contained in the bounded area.
- Sewage generated from the project site will be treated and disposed of through septic tank and soak pits;
- Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of.
- Construction vehicles and equipment will be serviced regularly
- The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals.
- Surface run-off from bunded areas will pass through oil/water separators prior to discharge to the stormwater system.
- A site-specific Emergency Response Plan will be prepared by the contractor for soil clean-up and decontamination.
- Any loading and unloading protocols should be prepared for diesel, oil and used oil respectively; and
- The construction contractor will implement a training program to familiarize staff with emergency procedures and practices related to contamination events

7.2.3.2 Soil contamination by waste generated

The following measure will be implemented to mitigate/avoid soil contamination by waste generation:

- The construction contractors will have control over the amount and types of waste (hazardous and non- hazardous) produced at the site. Workers will be strictly instructed about random disposal of any waste generated from the construction activity.

- Construction contractor should ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken from the site;
- Municipal domestic waste generated at site to be segregated onsite;
- Ensure hazardous waste containers are properly labelled and stored onsite provided with an impervious surface, shed and secondary containment system.
- Ensure routinely disposal of hazardous waste through approved vendors and records are properly documented.
- Construction contractor should ensure daily collection and periodic (weekly) disposal of construction waste generated debris, concrete, metal cuttings waste, waste/used oil etc.;
- Ensure hazardous waste is properly labeled, stored onsite at a location provided with impervious surface, shed and secondary containment system and;
- The municipal waste from the labor camp will only be routed through proper collection and handover to the local municipal body for further disposal. The hazardous wastes will be temporarily stored in labeled drums on the impervious surface at designated area onsite and will be disposed of through approved vendors.

The impact on soil contamination due to waste generation, spills and leaks will have a medium intensity within the project site for a short duration which will result in an overall minor impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **negligible**.

7.2.4 mitigation measures for soil erosion and compaction

The following measure will be implemented to mitigate the Soil Compaction and Erosion:

- The area to be cleared must be clearly demarcated and this footprint strictly maintained.
- Soil conservation measures will be implemented such as stockpiling topsoil or gravel for the remediation of disturbed areas.
- Scheduling activities (as far as possible) to avoid extreme weather events such as heavy rainfall and high winds;
- Work areas will be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint;
- It is recommended to grow turf grass around WTGs to avoid soil erosion
- Construction vehicles will remain on designated and prepared compacted gravel roads.

The impact on topsoil compaction and erosion will have a medium intensity within the project site for a short duration, which will result in an overall minor impact without mitigation. However,

with proper implementation of suggested mitigation measures, the overall impact will be **negligible**.

7.2.5 mitigation measures for surface water sources consumption

The following mitigation measures will be implemented to mitigate the impact on availability of surface water:

- Construction labor deputed onsite to be sensitized about water conservation and encouraged for optimal use of water.
- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers is necessary for efficient utilization of water.
- It should be ensured that water supply for the Project to be procured from approved suppliers and the approval copy of the same to be maintained to ensure the right source;
- Blending of low-quality water with fresh water for construction uses to ensure efficient use of natural resource.
- Recycling/reusing to the extent possible
- Use to extent possible wet technology for cleaning equipment to optimize the consumption of water
- Implement, if possible, a system to treat and reuse the wastewater

After implementation of the mitigation measures the magnitude of impact on surface water availability is assessed to be **minor**.

7.2.6 mitigation measures for groundwater sources

as noted above there will be no groundwater use during the project. The impact on the consumption of this resources is negligible. Thus, no mitigation measures will be implemented.

7.2.7 mitigation measures for surface water quality

7.2.7.1 wastewater/oil leaks and spills

The following measure will be implemented to mitigate the wastewater /oil spills leaks discharge:

- Fuel, oil and used oil storage areas will be contained in bunds of 110 percent capacity of the stored material.
- Refueling will be carried out in designated areas using strict protocols.
- Spill containment and clean up kits will be available on-site and clean-up from any spill will be appropriately contained and disposed of at a bound landfill site.

- Project staff will not be permitted to utilize any water sources (stream, river, or other water bodies) for the purposes of bathing, washing of clothing.
- Construction vehicles and equipment will be serviced regularly at off-site location.
- Ensure that all construction plant and equipment is maintained in a good state of repair with minimal leaks.
- Oil leakage or spillage will be contained and cleaned up immediately. Waste oil will be collected and stored for recycling or disposal.
- Oil and grease separator shall be used for wastewater generated from cleaning activities.
- Adequate sanitary facilities, i.e. toilets and showers, will be provided for the construction workforce;
- Workers will be trained in the use of designated areas/bins for waste disposal and encouraged to use toilets.
- Septic tanks will be provided to treat sanitary wastewater
- Use of licensed contractors for management and disposal of waste and sludge and
- All sewage and liquid effluent will be treated to meet the standards specified by the MEWA regulations and IFC guidelines EHS 2007

7.2.7.2 Sediment load

The following measure will be implemented to mitigate the sediment content in the water body:

- The drainage pattern of the site will not be altered, and the natural slope of the site will be maintained;
- Special care needs to be taken during the road construction to maintaining the standard slope as the soil cannot wash out in the water body. As well as need proper compaction of the road structure.
- Cover all slopes of the road by first growing grass.
- Adequate arrangement for stormwater management during construction period will be made to avoid sediment runoff from the site.
- Stormwater flow should be directed to the existing channels / Wadi with silt trap to avoid sedimentation of the canals or the receiving water body.

The impact on surface water quality will have low intensity with short-term duration which will result in an overall **minor** impact without mitigation. However, with proper implementation of suggested mitigation, the impact will be reduced to **negligible**.

7.2.8 mitigation measures for groundwater quality

The following measure will be implemented to mitigate the ground water by leaks and spills

- Fuel, lubricating oil, and used oil storage areas will be contained in the bounded area.
- Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of.
- Construction vehicles and equipment will be serviced regularly
- The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals.
- Surface run-off from bunded areas will pass through oil/water separators prior to discharge to the stormwater system.
- A site-specific Emergency Response Plan will be prepared by the contractor for soil clean-up and decontamination.
- Any loading and unloading protocols should be prepared for diesel, oil and used oil respectively.
- The construction contractor will implement a training program to familiarize staff with emergency procedures and practices related to contamination events.

Impact significance will be assessed as **negligible** after implementation of the mitigation measures.

7.2.9 mitigation measures for air quality

7.2.9.1 dust elimination

To reduce dust impacts, the following measures will be put in place:

- Implementation of a regular watering and sprinkling dust suppression regime, during the dry season.
- Stockpiles of dusty materials will be enclosed or covered by suitable shade cloth or netting to prevent the escape of dust during loading and transfer from Site.
- No stockpiles will be maintained outside, and maximum Possible distance between the stockpiles and receptors will be maintained.
- Covering and/or watering of all stockpiles of dusty materials such as excavated spoils to avoid fugitive dust emissions.
- During construction, the approach road will be kept clean, free from mud and slurry;
- Material transport will be totally enclosed with impervious sheeting and wheel washing will be carried out at site.

- Speed of vehicles on site and approach road will be limited to 15-20 km/hr which will help in minimizing fugitive dust emission due to vehicle movement
- Idling of vehicles and equipment will be prevented and
- Waste from construction will not be burned.
- Concrete, sand and aggregates shall be stored as far from sensitive receptors as possible and screened/shielded if they are located within 100m of sensitive receptor.
- The distance from receptors to dust emission sources (stockpiles etc) shall be maximized, with consideration of prevailing wind direction.
- Dusty materials shall be removed from construction sites as soon as possible.
- Transport of contaminated soil (if any) shall also be carried out with tight fitting covered trucks or closed containers.
- Loaded trucks to or from the work site area shall avoid heavily travelling through residential roads in the localities around.
- Traffic management measures shall reduce congestion: Planning of driving construction vehicles outside of the construction area during rush hour traffic.
- Implementation of a Dust Control Plan: The construction contractor shall draw up a Dust Control Plan in accordance with Air National Standards. The construction contractor:
 - ✓ Shall instigate effective dust suppression measures as may be necessary to avoid creating dust nuisance arising as a result of the Works on site.
 - ✓ Shall clearly identify proposed dust control measures intended to be implemented in detail as a part of a general method statement to be issued.
 - ✓ Shall ensure that all temporary construction shall be such that it will not allow the infiltration of any biological or chemical pollutants into the works.
 - ✓ The Dust Control Plan shall provide details of mitigation measures, specific location and schedule where such measures will be implemented to minimize impacts to sensitive receptors due to construction works, sourcing and transport of construction materials, and other project-related activities.
 - ✓ The construction contractor shall designate a person or several persons to monitor the Dust Control Plan, with authority to order additional sprinkling when needed to avoid dust problems around the construction site and on external roadways. This monitoring includes weekends and holidays when there is no work on the construction site.
 - ✓ The Dust Control Plan Report shall have at least the following content:

1.DUST CONTROL PLAN

- 1.1. Purpose
- 1.2. Air Standards and other National Legislation. Acceptable levels.
- 1.3. Time for completion
- 1.4. Quality assurance
- 1.5. Site working conditions
- 1.6. Local conditions
- 1.7. Material Support

2.SCOPE OF THE WORK

- 2.1. Measures to minimize dust and other emissions
- 2.2. Measures to monitor dust and other emissions

3.DELIVERABLES

Appendix: Monitoring Control Points.

The impact due to dust generation will have medium intensity with locally extent for a short- term duration which will result in an overall **minor impact** without mitigation. However, with proper implementation of suggested mitigation, the impact will be reduced to **negligible**.

7.2.9.2 Fugitive emission

Exhaust emissions will be minimized by following mitigation measures:

- ✓ The movement of construction vehicles will be minimized, and a 20 km/hr speed limit will be enforced in the project site as well as approach road.
- ✓ Vehicles traveling on gravel roads will not exceed a speed of 30 km/hr; All diesel-powered equipment will be regularly maintained and idling time reduced to minimize emissions;
- ✓ Low sulfur diesel ($S < 0.5\%$) will be used in diesel-powered equipment in collaboration with best management practices;
- ✓ Vehicle/equipment air emissions will be controlled by good practice procedures (such as turning off equipment when not in use);
- ✓ Vehicle/equipment exhausts observed emitting significant black smoke in their exhausts will be serviced/ replaced; and
- ✓ Implementation of an Engine **Emission Management Program**: According to Mobile Source Emissions Standard (The Executive Regulations for Air Quality NCEC-MEWA

2020), the owner or operator of a large site or facility (the construction contractor) must develop an internal management program. Large sites are those that have 5 or more engines, equipment and/or vehicles that have the potential to be operational at the same time. This engine emission management program shall include the following:

- A list of all applicable engines
- Engine maintenance procedures
- Procedures to ensure best available environmental technology are used where economically feasible
- Potential hazards and emergency response procedures.
- It is the responsibility of the site owner or his designated site manager to ensure the implementation and maintenance of the engine emission management program.
- All engine emission management program documentation shall be organized carefully and made available to the Competent Agency when required.
- Failure to submit internal management program documentation to the Competent Agency, within a 30 day period, will be deemed as a failure to comply with Mobile Source Emissions Standard of the Executive Regulations for Air Quality NCEC-MEWA 2020
- Solid waste burning in the project site is strictly prohibited
- The impact of exhaust emission will have high intensity with locally extent for a short-term duration which will result in an overall minor impact without mitigation. However, with proper implementation of suggested mitigation, the impact will be reduced to **negligible**.

7.2.10 mitigation measures for ambient noise

The following mitigation measures will be implemented to minimize potential noise impacts during the construction phase in all periods:

- The contractor should ensure that all construction equipment and vehicle is fitted with silencers (where possible).
- The contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work (this is a requirement of OSHA 2007).
- The contractor should undertake additional post development noise monitoring in accordance with National and International noise standards.

- Mobile noise sources such as cranes, earth moving equipment shall be routed in such a way that there is minimum disturbance to receptors.
- Developer shall instruct their Safety Officers to arrange for inherently quiet construction equipment and machines to maintain the noise level to minimum.
- Only limited construction activities shall be carried out during night-time.
- Restrict the night-time vehicle movement through the access road.
- Adopt the vehicle speed limit in the access road
- It is also to be ensured that no village road will be utilized for movement of equipment except the designated access road.
- The number of equipment operating simultaneously should be reduced as far as practicable.
- Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby NSRs as far as practicable.
- All loud and sudden noises will be avoided wherever possible and fixed noise sources shall be located at least 50m away from the site boundary.
- Rubber padding/noise isolators will be used for construction equipment
- Temporary noise barriers shall be provided surrounding the high noise generating construction equipment.
- The personnel involved in high noise generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels.
- Construction vehicles and machinery will be well maintained and not kept idling when not in use.

The impact of noise will have low intensity with locally extent for a short-term duration which will result in an overall **minor** impact without mitigation. However, with proper implementation of suggested mitigation, the impact will be reduced to **negligible**.

7.2.11 Mitigation measures for traffic and transport

The following mitigation measures will be taken to mitigate the traffic and transportation impact:

- The contractor should ensure that all WTGs and mounting structure components are transported in appropriate vehicles that adhere to the axle load limits.
- Only trained drivers with valid license shall be recruited by the construction contractor.
- Training programs shall be conducted at regular intervals for all the drivers for raising awareness about road safety and adopting best transport and traffic safety procedures once in every month.

- Additionally, speed limits for all construction related vehicles shall be adhered to at all times to prevent damage to roads and other infrastructure
- Mitigation measures such as emphasizing on safety amongst drivers, adopting limits for the trip duration and arranging driver roster to avoid overtiredness and avoiding dangerous routes and times of day to reduce the risk of the accident shall also be implemented.
- High visibility colors should be used during the transportation of WTGs to the project site.
- Regular maintenance of vehicles and use of manufacturer approved parts should be adopted to minimize potentially serious accidents caused by equipment malfunction or premature failure.
- The villagers will be made aware of the schedule prior to the movement of trucks and transportation of power plant equipment in the project area.
- Collaboration with local communities and responsible authorities to improve signage, visibility, and awareness of traffic and pedestrian safety.
- Notify the governing body and local area responsible person prior to start the construction work and put adequate signage around the construction area on both way and instruct the driver for carefully driving in close to the sensitive area;
- Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents.
- The existing earthen road should keep functional as the local people can use the road;
- Movement of the project traffic should be limited to the planned route only and;

The traffic movement in the settlement areas should be limited for the daytime only

The impact due to traffic and transport will have medium intensity with a local extent for a short duration which will result in an overall **minor** to **negligible** impact without mitigation. However, with proper implementation of suggested mitigation, the impact will be reduced to **negligible**.

7.2.12 mitigation measures for socio-economic impacts

7.2.12.1 mitigation measures for community health and safety

The mitigation measures that will be implemented during the construction phase to attenuate impact on community health and safety are:

- a) for traffic

- The truck drivers carrying construction machinery and materials will be instructed to drive within speed limits with careful consideration for villages traffic in vicinity.
- Movement of heavy equipment and construction materials will be regulated during peak hours (09:00 AM to 06:00 PM).
- Proper route of movement of project vehicles will be identified.
- Depute traffic escorts as and when required near project site and major settlements to guide movement of project vehicles.
- Keep limited speed of project vehicles near settlements and within the project site.
- Provide necessary training to the drivers for speed restrictions and on do's and don'ts.
- b) For waste management and disposal
 - The excavated areas will be properly fenced for safety and sign boards in local languages will be put up;
 - No hazardous waste or any waste be stored within the site for long periods of time and be in contact with the soil.
 - The quantity of domestic waste generated daily from the labor camps will be small and limited as most of the workers will be hired locally. However, the construction contractor shall ensure that the camp sites provided at the site have adequate waste disposal facilities. Arrangements for collection of garbage in dustbins and daily disposal to the nearest dump site shall be made. Provision of toilets for workers shall be made at the campsites in order to maintain hygienic and clean surroundings.
 - Effort should be made to use the locally available labor for unskilled work purpose.
 - Construction contractor will be followed the 3R policy to manage the solid waste management.
 - Nearby municipality may also be contracted for regular disposal of the labor camp waste.
 - Washing and bathing areas will be provided with a proper drainage system so that wastewater is not accumulated in the campsites. Disposal of sewage shall be made through a septic tank – soak pit arrangement.
 - Used or waste oil generated from generators and construction machinery and equipment will be stored on a paved surface in a secure location at the project site. Appropriate secondary containment capable of containing the 110 percent of the largest tank is to be provided.
 - The waste oil, which is characterized as hazardous will be sold to authorized vendors at frequent intervals.

- Empty fuel containers will also be stored at a secured area designated for scrap and sold to authorized vendors. All packaging material will also be collected at the storage area and sold to scrap dealers.
- Construction debris and excavated material will be stored in a confined area to prevent spread by wind or water.
- The construction debris will be used for backfilling of excavated areas and for foundation works at site.

The overall impact on community health and safety with the implementation of suggested mitigation measures, will be **negligible**.

7.2.12.2 Employment opportunities measures

The project is recommended to have the following mitigation measures in place:

- The local community is preferred by the project for the requirement of skilled, semiskilled and unskilled workers to the extent possible.
- The sourcing of local labor wherever possible should be made obligatory for the sub-contractors and in all major procurement activities.
- Preference should be given to the vulnerable population.
- The EPC Contractor/ and the MoE/MEWA will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labor and resources.

7.2.13 Mitigations measures for impacts from migrant workers

Potential impacts during construction period include impact due to the influx of migrants and associated health related risk to the community. These impacts are expected to be low and with the implementation of the following mitigation measures the potential impact due influx of migrant workers will be further minimized.

- Engage as many locally available unskilled, semi-skilled and skilled human resources as practically possible to avoid large scale in migration of labor force.
- Provision of infrastructure and amenities for migrant labor in construction camp to avoid dependence on limited local resources.
- Adequate sanitation facility at labor camps to maintain hygiene and minimize spread of diseases.
- Creating awareness about local tradition and culture among outside migrant and encouraging respect for same.

- Providing awareness training regarding infectious diseases among the migrant population.
- Proper disposal of wastes generated from the camp and construction activity to maintain general hygiene in the area.
- Avoid unnecessary movement of vehicles through near settlement areas to avoid disturbance and traffic safety related issues.

The impact due to influx of migrant worker will have medium intensity with a local spread for a short duration which will result in an overall low impact without mitigation. However, with proper implementation of suggested mitigation measures the overall impact will be **negligible**.

7.2.14 Mitigation measures for occupational health and safety

Following measures will be taken to minimize the health impact during construction phase:

- The workers (both regular and contractual) on the project will be provided with training on the Health and Safety policy in place, and their role in the site and refresher courses will be provided throughout the life of the project.
- Establish a grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities.
- Operation of loading-unloading equipment should be undertaken under the guidance/supervision of trained professional.
- The contractor should ensure that no person is engaged in driving or operating construction machinery unless he is sufficiently competent and reliable, possess the knowledge of risks involved in the operation and is medically examined periodically.
- Contractor should prepare a site Emergency Preparedness and Response Procedure, which should be followed for the subjected project.
- Adequate training should be provided to staff about raising awareness about use of Personal Protection Equipment (PPE) and emergency response measures;
- Job responsibility and shifting chart should be prepared so that no person shall be over exhausted, which will ultimately lead to the accident or injuries;
- Safety sign should also be marked at appropriate places.
- It shall also be ensured that good housekeeping at the construction site is maintained to avoid slips and falls.
- Excessive waste debris and liquid spills will be cleaned up regularly, while electrical cords and ropes will be placed along identified corridors marked for the attention of everyone at the site.

- Use of personal fall arrest system, such as full body harnesses as well as fall rescue procedures to deal with workers whose fall has been successfully arrested shall also be carried out.
- Dropping/lowering of construction material or tool will be restricted and undertaken only under strict supervision if required. PPEs such as safety glasses with side shields, face shields, hard hats and safety shoes shall be mandatory at a construction site. Earplugs shall be provided for workers placed in high noise areas.

The health and safety impact will have high intensity with a local spread for a long duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact significance after will be **negligible to minor**.

7.2.15 mitigation measures for ecological and biodiversity impacts

The following identifies the additional studies and mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- Should as part of the Project any fencing be erected, it must be ensured that it allows for the natural movement of small faunal species within the area. This could include for example a fence with an appropriate gap between the ground level and the first rail or strand (around 30 cm).
- One major modification that could take place at the project site is the removal of the trees. The trees are believed to be of significance for the biodiversity elements at the Project Site especially the birds. Therefore, the minimum number of trees should be removed from the project site in order to achieve the minimal impact possible on the biodiversity at the Project Site. The trees removed should be replaced by other trees to be planted in the vicinity of the project site in order to act as an offset for the removed trees and as a new refuge for the species affected.
- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising/training of personnel and good housekeeping which include the following:
 - Prohibit hunting at any time and under any condition by construction workers onsite.
 - Ensure proper storage, collection, and disposal of waste streams generated.
 - Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances.

- Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as **negligible** significant.

As per monitoring and reporting requirements during construction phase the EPC Contractor should inspect the works at all times.

7.3 Mitigation measures in operation and maintenance phase

7.3.1 Mitigation measures for Land and Soil Environment

7.3.1.1 Mitigation for Impact on Land due to Improper Waste Disposal

The following mitigation measures will be taken to manage the waste:

- The waste generated during operation phase will be disposed of through approved vendors.
- The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and send for disposal to nearest designated dumping site.
- During the operation phase, the quantity of municipal waste and hazardous waste generated is less and probability of the hazardous waste generation is only during maintenance and therefore occasional. The waste generated would be routed through proper collection and containment.
- The water for cleaning purpose of the WTGs remove dust from it is likely to get evaporate or absorbed by the vegetation and soil underneath the WTGs;
- The Operator/Contractor should make a MoU (Memorandum of Understanding) with the local municipality to collect the daily domestic for disposing of in the designated dumping site.

The impact on soil environment due to waste generation will have medium intensity with a local spread for a long duration which will result in an overall **moderate** impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **minor**.

7.3.1.2 Mitigation for impact on Soil Contamination due to Leaks/Spills

The following mitigation measures will be taken for controlling the leaks/spills of liquid effluent.

- Ensure oil/ lubricants are stored on impervious floor in the storage area having secondary containment.
- Use of spill control kits to contain and clean small spills and leaks during O&M activities; and
- The guidelines and procedures shall be prepared and followed for immediate clean- up actions following any spillages.

The impact on soil environment due to spills/leaks of liquid effluent will have medium intensity with a local spread for a long duration which will result in an overall moderate impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **minor**.

7.3.2 Mitigation measures for waste Generation

- The separate designated area should be earmarked for storage of hazardous waste like waste oil, transformer oil. These wastes shall be given to the MoE approved recyclers.
- Operation waste management will be governed by an Environmental Management Plan (EMP) and will incorporate reduction, recycling, and reuse principles.
- Material Safety Data Sheets for all applicable materials present on Site will be readily available to on-site personnel.
- All wastes produced from project activities on site will be transferred to designated temporary storage areas and where possible into secure containers.
- Solid wastes will be segregated to facilitate reuse and recycling of specific materials.
- All wastes that cannot be reused or recycled will be collected by approved waste contractors and transferred to an appropriately licensed waste management facility for treatment and disposal.
- First of all, inspection of Blades of WTGs can appear in the form of burn marks, discoloration, or broken fiberglass is to be undertaken. An authorized person will walk the site to confirm that there are no broken parts of WTGs
- Broken or damaged blades and parts of WTGs are required to be immediately shifted to a designated area in a scrap yard to avoid any type of land contamination. A photograph is to be taken of the broken parts at the site to cater to Insurance settlement claims.
- Once the WTGs have reached the end of their life cycle, the manufacturer of the WTGs will collect and recycle the WTGs and recover any hazardous substances in from the WTGs. This provision forms part of the supply agreement between the proponent and the selected WTGs manufacturer.
- Use the soak pit and septic tank in the office building and guard room for sewage.

The impact of waste and effluent from the operation of the project will have medium intensity with locally extent for a long duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **minor to negligible**.

7.3.3 Mitigation measures for Water Resources and Quality

7.3.3.1 Mitigations measures for Water Availability

The following measure will be implemented to mitigate the water consumption:

- variability and projected changes in demand in the Project area;
- Periodical training should provide to workers for best utilization of water.
- Bore-wells could be established, if deep aquifer is available is after requisite permission from the regulatory authority. Meters should be installed at the bore-wells to monitor the abstraction of water; this option proposed should be studied and assessed in advance.
- Wastage of water during cleaning of turbines and other facilities should be avoided; otherwise opt for dry cleaning technology. It would save considerably water.
- Drinking water demand should be met by bottle potable water purchased
- The wastewater emanating from cleaning operations shall be used for the irrigation of green spaces in project area. Wastewater reused should be in compliance with the Saudi regulations on wastewater reuse. and excess water shall be discharged after settling of the sediment.
- Appropriate drainage network should be planned in the project site.

The impact due to water abstraction from water sources from the neighbouring localities will have medium intensity with locally extent for a long duration which will result in an overall medium - moderate impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **minor**.

7.3.3.2 Mitigation measures for Impact on Water Quality

- The drainage and sewerage system will be provided for the collection and treatment of wastewater at SCADA building/ CMS and substation areas by establishing a septic tank or portable Wastewater Treatment plant (WWTP). This Alternative (WWTP) could allow to reuse the treated wastewater in compliance with Saudi Regulations for Wastewater treatment and reuse and it could save water. The better choice between the two alternatives should be the object of a technical and economic study
- No wastewater discharge on open land will be practiced.

- The plant site should be provided with adequate drainage facility to drain-off the rainy water and prevent any waterlogging at site or in the surroundings.
- No careless attitude in the handling of hazardous waste and oil should be tolerated during plant operation. If any oil spilled out accidentally, it should be cleaned and stored appropriately.
- Fuel, oil and used oil storage areas will be contained in bunds of 110% capacity of the stored material.

The impact due to water abstraction from River and ground will have low intensity with locally extent for a long duration which will result in an overall low impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **negligible**.

7.3.4 Mitigations measures for Impact on Air Quality

- Vehicles traveling on gravel roads should not exceed a speed of 30 km/hr.
- Regular water spray is required on unpaved road as the dust not move during heavy wind;
- Use clean fuel in vehicle as the exhaust emission will be low

The Implementation of these mitigation measure will lead to an overall **negligible** impact.

7.3.5 Mitigation measures for Impact on Ambient Noise Levels

- Periodic maintenance of machinery and vehicles used on the site.
- Inverters and transformers should be well maintained and provided by noise reduction system. (noise barriers, sound absorbing noise barriers ..)
- Periodic monitoring of noise near to the sources of generation, like transformers, to ensure compliance with design specification.

with proper implementation of suggested mitigation measures, the overall impact will be very **negligible**.

7.3.6 Mitigation measures for impact on Ecology and biodiversity

The following identifies the mitigation measures to be applied by the Project Operator during the operation phase and which include:

- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising/training of personnel and good housekeeping which include the following:
- Prohibit hunting at any time and under any condition by workers onsite.

- Ensure proper storage, collection, and disposal of waste streams.
- Restrict activities to allocated areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as **negligible**.

As per monitoring and reporting requirements during operation phase the Project Operator should inspect the works at all times.

7.3.7 Mitigation measures for Visual Impact

- The WTGs will be installed at a high area and scattered by all the project area it does not pop out of the general landscape.
- WTGs are arranged in a systematic manner which will give an aesthetic sense to it.
- The proposed Wind power project would include a boundary wall around the perimeter of the project to further obscure the peripheral view of the project and any indirect reflection. Impacts from glare would be minor.
- All cables and power lines will be located underground as far as possible.
- The substation, gatehouses and maintenance and storage buildings will be grouped as far as possible to avoid the scatter of buildings in the open landscape.
- The design of the buildings will be compatible in scale and form with the building style of the region.
- All yards and storage areas to be enclosed by masonry walls or screens.
- External lighting will be confined to the substations and maintenance areas. Lights will be low-level and fitted with reflectors to avoid light spillage.
- Signages related to the enterprise are to be discrete and confined to the entrance gates. No other corporate or advertising signage, particularly billboards or flags, to be permitted.
- All lighting will be kept to a minimum within the requirements of safety and efficiency.
- Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce light spillage and pollution, will be used.
- No naked light sources will be directly visible from a distance. Only reflected light will be visible from outside the Site.
- External lighting will use down-lighters shielded in such a way as to minimize light spillage and pollution beyond the extent of the area that needs to be lit.
- Security and perimeter lighting will also be shielded so that no light falls outside the area needing to be lit. Unnecessarily tall light poles are to be avoided.

- Warning signs at appropriate distances indicating Wind Power plant location should be placed to alert road users.

The visual impact will have medium intensity with a local spread for a long duration which will result in an overall Medium Low impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **negligible**.

7.3.8 Mitigations measures for impact on Occupational Health and Safety

The following mitigation measures will be taken to minimize the health impact during operation phase:

- Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears.
- Adequate training regarding health and safety will be provided to the workers.
- A health, safety, and environment (HSE) management system will be developed, rolled out and implemented. This system which will be reviewed annually or after a major accident or incident
- The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire.
- Safety incidents will be recorded and monitored with an aim that numbers are never significant, and gradually reduce.
- Workers at site handling broken WTGs compounds shall be provided with adequate PPEs (safety gear, goggles, and gloves).
- The workers at the site are also on regular basis shall be appraised about the potential health risks associated with the handling of WTGs compounds.
- Ensure use of safety belt and need for safety net as required;
- All work at height to be undertaken during daytime with sufficient sunlight except emergency (with proper illumination arrangement);
- Fixtures shall be installed on tower components to facilitate the use of fall protection systems;
- Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment shall be engaged for work at height;
- Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears. Adequate training regarding health and safety will be provided to the workers;

- Access to areas containing exposed electrical equipment (such as transformers) shall be fenced and locked. Warning signs shall be posted at hazardous locations;
- Firefighting equipment such as fire extinguishers and sand buckets shall be provided at appropriate locations;
- Workers involved in electric operations shall be provided with Protective Equipment such as rubber gloves etc;
- Employees involved in electrical works shall be trained in and familiar with the safety-related work practices, safety procedures, and other safety requirements that pertain to their respective job assignments.
- First aid box/ arrangement to be ensured

The impact on health and safety from the operation of the project will have medium intensity with locally extent for a long duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact will be **minor**.

7.3.9 Mitigations measures for impact Traffic and Transport

During operation, if abnormal loads are required for maintenance, the appropriate arrangements will be made to obtain the necessary transportation permits and the route agreed with the relevant authorities to minimize the impact of other road users.

Unnecessary travels outside the plant should be avoided at the extent possible. The impact significance is assessed as **negligible**.

7.4 Mitigation measures in decommissioning phase

7.4.1 Mitigations measures for impact on Soil Environment

Following mitigation measures are proposed to reduce the impacts of Wind Power plant decommissioning activities on soil environment:

- The decommissioning of the Wind Power plant will be carried out in a planned manner.
- During decommissioning phase, the quantity of waste generated will be high. The waste will be routed through proper collection, storage and disposal. The waste will be evaluated for its recycling/ reuse/ scrap value and disposed accordingly.
- The vehicular movement during decommissioning activities should be restricted to the designated route path;
- The demolition/ dismantling waste should not be left over in the project area and to be collected and stored at designated area only for further segregation and disposal.

The significance of impacts due to waste generation and soil contamination after implementation of mitigation measures will be **negligible**.

7.4.2 Mitigations measures for Impact on Water Environment

To mitigate the impact on water environment and protect the water from contamination the following measures should be implemented:

- The provisions of septic tank and soak pits will be provided onsite for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge. Planning of toilets, soak pits and septic tanks, waste collection areas should be away from natural drainage channels;
- Use of licensed contractors for management and disposal of waste and sludge;
- Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages;
- Water tankers with proper permissions will be utilized for water sourcing.
- Ensure proper cover and stacking of loose construction material to prevent surface runoff and contamination of receiving water body;
- Laborers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Any random disposal of sewage shall be strictly restricted;
- Construction labor deputed onsite to be sensitized about water conservation and encouraged for optimal use of water;
- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers.
- Recycling/reusing to the extent possible.

The residual impact significance is envisaged to be **negligible** upon application mitigation measures.

7.4.3 Mitigations measures for impact on Air Quality

Good air quality should preserved in decommissioning phase by applying the following mitigations measures:

- Emissions from the emergency DG set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained.
- Minimize stockpiling by coordinating excavations, spreading and restoring land activities.
- Speed of vehicles on site will be limited to 10-15 km/hr which will help in minimizing fugitive dust emissions due to vehicular movement

- A dust management plan should be applied
- Idling of vehicles and equipment will be prevented.
- Burning of any waste material shall be prevented.
- Laborers shall be provided with natural gas connection to prevent burning of fuel wood for cooking or heating purposes.
- Work shall be ceased or phased down if excess fugitive dust is observed. Source of dust shall be investigated, and proper suppression measures ensured.
- Proper maintenance of engines and use of vehicles well maintained shall be ensured.
- WTGs parts should be handled properly to do not be damaged on site

The significance of residual impact will be **negligible** after implementing mitigation measures because of the fugitive dust emissions anticipated during demolition activities.

7.4.4 Mitigation measures for impact on Ambient Noise

Non-Noisy ambient environment within the project site should be guaranteed in decommissioning phase by implementing the following mitigations measures

- Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate noise.
- Only well-maintained equipment should be operated on-site;
- If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components should be carried out to bring down the noise and placing such machinery far away from the households as possible.
- Machinery and equipment that may be in intermittent use should be shut down or throttled down during non-work periods; and
- Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged.

Significance of residual impact is assessed to be negligible upon incorporation of the above-mentioned mitigation measures.

7.4.5 Impact on Economy and Employment

The decommissioning phase will require removal of machinery, workers and other temporary structures. The mitigation measures for decommissioning shall include the following:

- O&M Contractor should ensure that retrenchment packages are provided for all staff who stand to lose their jobs when the plant is decommissioned.
- The contractor shall inform the workers about the duration of work;
- Reduction of worker will be done phase wise and corresponding to completion of each activity; and
- All waste generated from demobilization shall be collected and disposed of at the nearest municipal disposal site.

Significance of residual impact is assessed to be **negligible** upon incorporation of the above-mentioned mitigation measures.

7.4.6 Mitigations measures for impacts on occupational health and safety

Following measures will be taken to minimize the health impact during decommissioning phase:

- The workers of decommissioning phase will be provided with training on the Health and Safety policy in place, and their role in the site and refresher courses will be provided throughout the life of the project.
- Operation of loading-unloading equipment should be undertaken under the guidance/supervision of trained professional.
- The contractor should ensure that no person is engaged in driving or operating dismantling machinery unless he is sufficiently competent and reliable, possess the knowledge of risks involved in the operation and is medically examined periodically.
- Contractor should prepare a site Emergency Preparedness and Response Procedure, which should be followed for the subjected project.
- Adequate training should be provided to staff about raising awareness about use of Personal Protection Equipment (PPE) and emergency response measures;
- Job responsibility and shifting chart should be prepared so that no person shall be over exhausted, which will ultimately lead to the accident or injuries;
- Safety sign should also be marked at appropriate places.
- It shall also be ensured that good housekeeping at the construction site is maintained to avoid slips and falls.
- Excessive waste debris and liquid spills will be cleaned up regularly, while electrical cords and ropes will be placed along identified corridors marked for the attention of everyone at the site.

- Use of personal fall arrest system, such as full body harnesses as well as fall rescue procedures to deal with workers whose fall has been successfully arrested shall also be carried out.
- Dropping/lowering dismantled objects or tool will be restricted and undertaken only under strict supervision if required. PPEs such as safety glasses with side shields, face shields, hard hats and safety shoes shall be mandatory at a construction site. Earplugs shall be provided for workers placed in high noise areas.

The health and safety impact will have high intensity with a local spread for a long duration which will result in an overall medium-low impact without mitigation. However, with proper implementation of suggested mitigation measures, the overall impact significance after will be **minor to moderate**.

8. STAKEHOLDER ENGAGEMENT PLAN

8.1 Overview

Stakeholder engagement can be described as the systematic method to understand and involve stakeholders and their concerns in project activities and decision-making processes. It identifies the appropriate approach to be used for consultation and information disclosure.

The Stakeholder Engagement Plan (SEP) for Starah Wind Power Plant has been prepared to guide stakeholder engagement for the project. The Stakeholders included to this plan include persons or groups that may be directly or indirectly affected by the project, as well as those that may have interest in the project and/or those that may influence the projects outcome either positively or negatively. These stakeholders may change over time and as such this plan will need to be updated as and when new stakeholders are identified, or the circumstances of stakeholders evolve.

The SEP has been prepared according to applicable IFC Performance Standards on “Social and Environmental Assessment and Management Systems” (first performance standard), as well as Equator Principle 5: Stakeholder Engagement and Equator Principle 6: Grievance Mechanism.

The SEP cannot be considered definitive for the lifetime of the project. As such, the SEP will evolve over time as the project progresses and will be updated as necessary to include any relevant changes.

It should be recognized that the SEP is a living document and will be utilized throughout the lifecycle of the project to guide the necessary engagement with identified stakeholders at the various project phases.

8.2 Stakeholder identification and analysis

The first step in the process of Stakeholder Engagement Plan is stakeholder identification—determining who your project stakeholders are, and their key groupings and sub-groupings. This section of the SEP identifies the key stakeholder groups and analyses how they may be affected by the project, at the respective project stages.

8.2.1 Identified stakeholders

The stakeholders of the project are classified in two categories:

- Affected Stakeholders, i.e. the people or institutions that may potentially be affected by one or more of the potential impacts of the project.

- Interest Based Stakeholders, which potentially include public agencies concerned with any of the project activities, national and international non-governmental organizations, and the interested part of the civil society.

The table below outlines the identified stakeholders and their interest in the project. This list is not exhaustive and may be completed. Where applicable this SEP will include differentiated measures to allow the effective participation of those identified as disadvantaged or vulnerable stakeholders.

8.2.2 Affected stakeholders

The Affected or Impacted stakeholders are individuals or group of people that can be potentially affected by the projects' environmental and social impacts either directly or indirectly. Identified stakeholders that can potentially be directly impacted by the Project are listed in the table below.

Table 128 : Identified Potentially Affected Stakeholders

Stakeholders	Relation with the project
Shepherders / Camel herders	Project Affected People – Need to be resettled from the site.
AL Aflaj Municipality	Wind power plant on the territory
AL Hadar Municipality	Wind power plant on the territory
Ministry of Interior	Security restrictions that must be considered
Ministry of defense	Security restrictions that must be considered
Ministry of National Guard	Security restrictions that must be considered
National Center for Vegetation Cover	Biodiversity protection / Environmental restrictions
The National Centre for Wildlife	Biodiversity protection / Environmental restrictions
General Authority of Civil Aviation	The flight way, if any, in the project area (impacts of wind turbine)

8.2.3 Interest Based Stakeholders

It is important to also include in your stakeholder analysis those groups or organizations that are not adversely affected, but whose interests determine them as stakeholders. Interest-based stakeholders are groups or organizations that are not adversely affected by the project but whose interests determine them as stakeholders. The identified interest-based stakeholders for the project are presented in the table below.

Table 129 : Identified Interest-Based Stakeholders

Stakeholders	Relation with the project
Ministry of Municipal, Rural Affairs and Housing:	

Stakeholders	Relation with the project
• Riyadh Amanah • Al Aflaj Municipality. • Hadar Municipality • General Administration of Studies and Designs. • Construction Agency. • General Department of Urban Planning. • Provincial Planning Department.	Wind power plant on the territory (Master plan, Current and future plans to residential or commercial extension near the project area) / Municipal Permit
Minister of Environment, Water and Agriculture	Plans for future protected area expansion / Predicted future Protected zone
• National Center for Vegetation Cover	Plans for future area (Agriculture / vegetation / parks)
• National Center for Environmental Compliance	Environmental Permit to Construct / Environmental Permit to Operate
• Water & Electricity Regulatory Authority (WERA)	ECRA - License / permit to practice the activities
Saudi Electricity Company	Neighbouring / Future projects : Substation, Network Grid. Supporting the company's efforts by providing renewable energy sources
The Ministry of Transport and Logistic Services	Transport and traffic organization
Transport General Authority	Neighbouring / Transport and traffic organization
Saudi Railway Company (SAR)	Current and future plans for the railways around the project site
Ministry of Tourism	The project could impact tourism activities
(Branch of Ministry of Tourism in Riyadh)	
The Ministry of Culture	Interest in the development of the project. Interest may include potential environmental and social risks related to the project construction.
Heritage Commission	Heritage and historical features around the project site
Ministry of Labor and Social Development	Employment
Minister of Commerce and Investment	The project will impact commercial and industrial development
The Ministry of Communications and Information Technology	Future projects: telecommunications networks, relay towers, broadcasting stations, and landline telephone lines at the project site

Stakeholders	Relation with the project
The Communications and Information Technology Commission	Future projects of the Commission close to the project site
Ministry of Defense	It is important to see if there is any proposed development of the military area in the future.
Saudi Authority for Industrial Cities and Technology Zones	Industrial projects close to the project / Industrial Permit
High Commission for Industrial Security	HCIS permit

The list of permits required for the project is the following:

- Environmental permit to Construct.
- Environmental permit to Operate.
- Municipal Permit.
- Industrial Permit.
- ECRA Permit.
- HCIS Permit (related to Industrial Security).

8.3 Proposed stakeholder engagement activities

8.3.1 Proposed engagement activities

In keeping with the applicable reference framework and the expectations of the stakeholders, the project will undertake regular engagement with the key stakeholder groups identified, throughout the life of the project.

Stakeholder engagement is an ongoing process that will be undertaken during the design, construction, and operational phases of the project. The process intends to be transparent, free of intimidation, interference, and coercion. The aim of this section is to describe what information will be disclosed, in what formats, the types of methods that will be used to communicate information and the consultation methods to be used with each of the stakeholder groups identified in the previous sections.

The primary purpose of the ongoing engagement will be to allow the stakeholders to participate in the decision-making process for the project.

8.3.2 Engagement Methods

The following methods will be used to inform stakeholders about the ongoing stakeholder engagement process during the construction and operations of the project:

- Letters, Phone calls, and email - Suitable to engage interest-based stakeholders listed in previous sections and to notify them of the engagement and disclosure mechanisms.
- Posters or Notices - Signboards and Illustrative posters (infographics) will be placed at the project entrance gate, including direct access to the grievance mechanism.
- Bilateral meetings - Suitable to engage impacted and interest-based stakeholders as identified, to allow these stakeholders to provide their views and opinions and to notify them of the engagement and disclosure mechanisms.
- Online – Useful for Interest-based Stakeholders. The engagement and disclosure mechanisms for the ESIA package during the construction and operational phases of the project will be advertised on the Ministry website with a contact point provided for comment.

8.3.2.1 Stakeholder Engagement During the design phase

Experience from the preparation of the SEP has demonstrated the benefits of a participatory approach, with stakeholders involved throughout the SEP preparation process, from the design stage and site selection. In particular, the early and ongoing involvement of local authority Members in the process brings significant benefits, to the process and understanding of the preferred policies which they will ultimately be asked to adopt.

Table 130 : Proposed Stakeholder Engagement Activities (Design Phase)

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
Information disclosure (Project, ESIA process, SEP)	Ministry of Municipal, Rural Affairs and Housing: - Riyadh Amanah • Al Aflaj Municipality. • Hadar Municipality • General Administration of Studies and Designs. • Construction Agency. • General Department of Urban Planning. • Provincial Planning Department.	Wind Farm on the territory (Master plan, Current and future plans to residential or commercial extension near the project area) / Municipal Permit	Communication with authorities will follow established procedures in line with Saudi regulations: Focus Discussions. Official emails or letters informing the stakeholders	Share all required information related to the project: Master plan, Currents and future projects. Share all Requirements for Municipal permit

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	Minister of Environment, Water and Agriculture	Plans for future protected area expansion / Predicted future Protected zone	about the Project. Regular Meetings.	Define the Protected Zone / Define the Buffer zone / future Predicted area
	National Center for Vegetation Cover	Plans for future area (Agriculture / vegetation / parks)		Define the future agriculture zone and future Parks
	National Center for Environmental Compliance	Environmental Permit to Construct / Environmental Permit to Operate		***
	Water & Electricity Regulatory Authority (WERA)	ECRA - License / permit to practice the activities		Share all required information related to the project: Future networks grid and projects
	Saudi Electricity Company	Neighbouring / Future projects: Substation, Network Grid. Supporting the company's efforts by providing renewable energy sources		Provides all technical information for the project, especially Saudi standards and specifications.
	The Ministry of Transport and Logistic Services	Transport and traffic organization		Provides all current and future Plans (railways, roads)
	Transport General Authority	Neighbouring / Transport and traffic organization		
	Saudi Railway Company (SAR)	Current and future plans for the railways around the project site		
	Ministry of Tourism			

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	(Branch of Ministry of Tourism in Riyadh)	The project could impact tourism activities		Define all areas of tourist interest
	The Ministry of Culture	Interest in the development of the project. Interest may include potential environmental and social risks related to the project construction.		Define all historical and heritage area
	Heritage Commission	Heritage and historical features around the project site		
	Ministry of Labor and Social Development	Employment		****
	Minister of Commerce and Investment	The project will impact commercial and industrial development		Provides all current and future projects and plans around the project site
	The Ministry of Communications and Information Technology	Future projects: telecommunications networks, relay towers, broadcasting stations, and landline telephone lines at the project site		
	The Communications and Information Technology Commission	Future projects of the Commission close to the project site		
	Saudi Authority for Industrial Cities and Technology Zones The High Commission for Industrial Security	Industrial projects close to the project / Industrial Permit		
	Ministry of Interior	Security restrictions that must be considered		Define and clarify all restrictions and security precautions that must be
	Ministry of defense	Security restrictions that must be considered		

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	Ministry of National Guard	Security restrictions that must be considered		taken in the project area
	National Center for Vegetation Cover	Biodiversity protection / Environmental restrictions		Define the Protected Zone / Define the Buffer zone / future Predicted area
	The National Centre for Wildlife	Biodiversity protection / Environmental restrictions		
	General Authority of Civil Aviation	The flight way, if any, in the project area (impacts of wind turbine)		Provide all flight way that may be affected

**The suitable participation method will be chosen by the Ministry of Energy.

***Stakeholders not involved in this phase.

8.3.2.2 Stakeholder Engagement during Pre-Construction Phase

Before construction, in line with the respective SEP, the EPC will notify the local authorities to agree on the date and location of a 'Pre-Construction Awareness Meeting'. The EPC sends notification letters and meets local authorities' representatives to confirm the key activities to be undertaken, discuss sensitive areas for construction traffic safety, outline potential employment opportunities, discuss issues of concern for the local authorities, and confirm contact details.

The intended audiences of the pre-construction awareness meetings include interested stakeholders, representatives of local authorities and local businesses, land users, and other interested individuals.

The purpose of the meeting is to:

- Explain the upcoming construction activities in the site and present the works schedule.
- Discuss community health and safety aspects and arrangements.
- Notify attendees of available employment opportunities and the associated employment process.
- Present them of the grievance process and grievance mechanism contacts.
- Get stakeholders' feedback on issues and concerns.

Table 131 : Proposed Stakeholder Engagement Activities Pre-Construction Phase

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
Notify stakeholders of construction activities and construction timeline	- Ministry of Municipal, Rural Affairs and Housing:	Wind farm on the territory (Master plan, Current and future plans to residential or commercial extension near the project area) / Municipal Permit	Communication with authorities will follow established procedures in line with Saudi regulations: Focus Discussions. Official emails or letters informing the stakeholders about the Project. Regular Meetings.	Approve the project and all construction plans
	- Riyadh Amanah			
	Al Aflaj Municipality.			
	Hadar Municipality			
	General Administration of Studies and Designs.			
	Construction Agency.			
	General Department of Urban Planning.			
	Provincial Planning Department.			
	- Minister of Environment, Water and Agriculture	Plans for future protected area expansion / Predicted future Protected zone		Environmental Permit to Construct
	National Center for Vegetation Cover	Plans for future area (Agriculture / vegetation / parks)		
	National Center for Environmental Compliance	Environmental Permit to Construct / Environmental Permit to Operate		
	Water & Electricity Regulatory Authority (WERA)	ECRA - License / permit to practice the activities		ECRA permit
	- Saudi Electricity Company	Neighbouring / Future projects: Substation, Network Grid.		Approval of the project after ensuring that national specifications and standards are respected
		Supporting the company's efforts by providing renewable energy sources		
	- The Ministry of Transport and Logistic Services	Transport and traffic organization		Approve the project and all construction plans
	Transport General Authority	Neighbouring / Transport and traffic organization		
	Saudi Railway Company (SAR)	Current and future plans for the		

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
		railways around the project site		
	- Ministry of Tourism (Branch of Ministry of Tourism in Riyadh)	The project could impact tourism activities		
	- The Ministry of Culture	Interest in the development of the project. Interest may include potential environmental and social risks related to the project construction.		
	Heritage Commission	Heritage and historical features around the project site		
	- Ministry of Labor and Social Development	Employment		***
	- Minister of Commerce and Investment	The project will impact commercial and industrial development		
	The Ministry of Communications and Information Technology	Future projects: telecommunications networks, relay towers, broadcasting stations, and landline telephone lines at the project site		
	The Communications and Information Technology Commission	Future projects of the Commission close to the project site		
	Saudi Authority for Industrial Cities and Technology Zones High Commission for Industrial Security	Industrial projects close to the project / Industrial Permit		
	Ministry of Interior	Security restrictions that must be considered		Approval of the project after ensuring that

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	Ministry of defense	Security restrictions that must be taken into account		security restrictions and precautions are respected
	Ministry of National Guard	Security restrictions that must be taken into account		
	National Center for Vegetation Cover	Biodiversity protection / Environmental restrictions		Approve the project and all construction plans
	The National Centre for Wildlife	Biodiversity protection / Environmental restrictions		
	General Authority of Civil Aviation	The flight way, if any, in the project area (impacts of wind turbine)		***

**The suitable participation method will be chosen by the Ministry of Energy

***Stakeholders not involved in this phase.

8.3.2.3 Stakeholder Engagement during Construction Phase

Permanent on-site presence is ensured by all stakeholder engagement function teams to address the concerns and requests of stakeholders during construction works.

Based on the local context and on community tier classification, engagement by the Integrated Stakeholder Engagement Team during construction in a particular community area may include:

- Stakeholder engagement/meetings.
- Health and safety awareness training.
- Communication campaigns (local TV, posters, leaflets, social media, etc.).
- Employment opportunities.
- Other engagement in response to the interests and needs of stakeholders.

Stakeholder engagement activities by EPC Contractors during construction include the disclosure of information and engagement relating to project impacts. This engagement addresses aspects related to environmental, community health and safety, and security issues as well as grievance management.

Table 132 : Proposed Stakeholder Engagement Activities during Construction Phase

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
Notify stakeholders of construction activities and construction timeline Implementation of grievance mechanism Monitoring of the project activities and regular engagement Project Status Update	- Ministry of Municipal, Rural Affairs and Housing:	Wind power plant on the territory (Master plan, Current and future plans to residential or commercial extension near the project area) / Municipal Permit	Communication with authorities will follow established procedures in line with Saudi regulations: Focus Discussions. Official emails or letters informing the stakeholders about the Project. Regular Meetings.	Municipal Inspection
	- Riyadh Amanah			
	AL Aflaj Municipality.			
	Hadar Municipality.			
	General Administration of Studies and Designs.			
	Construction Agency.			
	General Department of Urban Planning.			
	Provincial Planning Department.			
	- Minister of Environment, Water and Agriculture	Plans for future protected area expansion / Predicted future Protected zone		Environmental Inspection
	National Center for Vegetation Cover	Plans for future area (Agriculture / vegetation / parks)		
	National Center for Environmental Compliance	Environmental Permit to Construct / Environmental Permit to Operate		
	Water & Electricity Regulatory Authority (WERA)	ECRA - License / permit to practice the activities		Ecra inspection
	- Saudi Electricity Company	Neighbouring / Future projects: Substation, Network Grid. Supporting the company's efforts by providing renewable energy sources		Ensure that national specifications and standards are respected
	- The Ministry of Transport and Logistic Services	Transport and traffic organization		***
	Transport General Authority	Neighbouring / Transport and traffic organization		
	Saudi Railway Company (SAR)	Current and future plans for the		

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
		railways around the project site		
	- Ministry of Tourism (Branch of Ministry of Tourism in Riyadh)	The project could impact tourism activities		
	- The Ministry of Culture	Interest in the development of the project. Interest may include potential environmental and social risks related to the project construction.		
	Heritage Commission	Heritage and historical features around the project site		
	- Ministry of Labor and Social Development	Employment		Inspection / Ensure the compliance with national laws
	- Minister of Commerce and Investment	The project will impact commercial and industrial development		
	The Ministry of Communications and Information Technology	Future projects: telecommunications networks, relay towers, broadcasting stations, and landline telephone lines at the project site		***
	The Communications and Information Technology Commission	Future projects of the Commission close to the project site		Coordination / Ensure that national specifications and standards are respected
	Saudi Authority for Industrial Cities and Technology Zones	Industrial projects close to the project / Industrial Permit		

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	High Commission for Industrial Security			
	Ministry of Interior	Security restrictions that must be taken into account		Ensure that security restrictions and precautions are respected
	Ministry of defense	Security restrictions that must be considered		
	Ministry of National Guard	Security restrictions that must be taken into account		
	National Center for Vegetation Cover	Biodiversity protection / Environmental restrictions		Environmental Inspection
	The National Centre for Wildlife	Biodiversity protection / Environmental restrictions		
	General Authority of Civil Aviation	The flight way, if any, in the project area (impacts of wind turbine)		***
	Shepherders / Camel herders	Neighbouring	Bi-Lateral meeting As described in the grievance mechanism section of this SEP	***

**The suitable participation method will be chosen by the Ministry of Energy

***Stakeholders not involved in this phase.

8.3.2.4 Stakeholder Engagement During Operation

Stakeholder engagement during the operational phase of the project will be the responsibility of the O&M Company, although it is expected that the Ministry of Energy will provide key support to ensure local cultural context during engagement activities.

It will be important for the Ministry of Energy and O&M Company to ensure a smooth transition between stakeholder engagements from the construction phase to the operational phase of the project by understating the techniques that have been most effective during construction. It will be important to continue these techniques to avoid the decrease in the frequency of stakeholder engagements, as the stakeholders are already familiar with the typical processes for engagement.

Table 133 : Proposed Stakeholder Engagement Activities during Operational Phase

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
Notify stakeholders of the transition from construction to operations Implementation of grievance mechanism Monitoring of the project activities and regular engagement Project Status Update	- Ministry of Municipal, Rural Affairs and Housing:	Wind power plant on the territory (Master plan, Current and future plans to residential or commercial extension near the project area) / Municipal Permit	Communication with authorities will follow established procedures in line with Saudi regulations: Focus Discussions. Official emails or letters informing the stakeholders about the Project. Regular Meetings.	Municipal Inspection
	- Riyadh Amanah			
	Al Aflaj Municipality.			
	Hadar Municipality			
	General Administration of Studies and Designs.			
	Construction Agency.			
	General Department of Urban Planning.			
	Provincial Planning Department.			
	- Minister of Environment, Water and Agriculture	Plans for future protected area expansion / Predicted future Protected zone		Environmental Permit to Operate / Inspection
	National Center for Vegetation Cover	Plans for future area (Agriculture / vegetation / parks)		
	National Center for Environmental Compliance	Environmental Permit to Construct / Environmental Permit to Operate		
	Water & Electricity Regulatory Authority (WERA)	ECRA - License / permit to practice the activities		Ecra inspection

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	- Saudi Electricity Company	Neighbouring / Future projects: Substation, Network Grid. Supporting the company's efforts by providing renewable energy sources		Coordination with operational managers
	- The Ministry of Transport and Logistic Services	Transport and traffic organization		
	Transport General Authority	Neighbouring / Transport and traffic organization		
	Saudi Railway Company (SAR)	Current and future plans for the railways around the project site		***
	- Ministry of Tourism (Branch of Ministry of Tourism in Riyadh)	The project could impact tourism activities		
	- The Ministry of Culture	Interest in the development of the project. Interest may include potential environmental and social risks related to the project construction.		If any historical sites or monuments will be discovered
	Heritage Commission	Heritage and historical features around the project site		
	- Ministry of Labor and Social Development	Employment		Inspection / Ensure the compliance with national laws
	- Minister of Commerce and Investment	The project will impact commercial and industrial development		***

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	The Ministry of Communications and Information Technology	Future projects: telecommunications networks, relay towers, broadcasting stations, and landline telephone lines at the project site		
	The Communications and Information Technology Commission	Future projects of the Commission close to the project site		
	Saudi Authority for Industrial Cities and Technology Zones High Commission for Industrial Security	Industrial projects close to the project / Industrial Permit		
	Ministry of Interior	Security restrictions that must be taken into account		coordination with project manager
	Ministry of defense	Security restrictions that must be taken into account		
	Ministry of National Guard	Security restrictions that must be taken into account		
	National Center for Vegetation Cover	Biodiversity protection / Environmental restrictions		Environmental Inspection
	The National Centre for Wildlife	Biodiversity protection / Environmental restrictions		
	General Authority of Civil Aviation	The flight way, if any, in the project area (impacts of wind turbine)		***

Activity	Stakeholders	Relation with the project	Engagement Methods options**	Stakeholders Engagement
	Sheepherders / Camel herders	Neighbouring	Bi-Lateral meeting As described in the grievance mechanism section of this SEP	***

**The suitable participation method will be chosen by the Ministry of Energy

***Stakeholders not involved in this phase.

8.4 Grievance mechanism

For projects with environmental and social impacts, grievances are a fact of life. How a company responds when such grievances surface is important and can have significant implications for business performance.

A grievance mechanism should be scaled to fit the level of risks and impacts of a project. It should flow from a company's broader process of stakeholder engagement and business integrity principles and integrate the various elements of engagement discussed in the preceding sections. In fact, having a good overall community engagement process in place and providing access to information on a regular basis can substantially help to prevent grievances from arising in the first place, or from escalating to a level that can potentially undermine business performance.

The aim of the grievance mechanism is to establish a system to receive and facilitate resolution of the stakeholder's concerns and grievances about the Project's environmental and social performance. The grievance mechanism has the Affected Communities as its primary beneficiaries. It seeks to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate and readily accessible at no cost and without retribution to the party that originated the issue or concern. The mechanism will not impede access to judicial or administrative remedies.

8.4.1 Scope of Grievance Mechanism

The scope of the grievance mechanism is to cover all stakeholder's problems and concerns regarding project activities and the implementation of the mitigation and compensation measures. Generally, all claims from affected communities should be accepted and no judgment made prior to investigation, even if grievances are minor. However, according to best practice, the following claims should be directed outside of project-level mechanisms:

- Grievances clearly not related to the project: It is sometimes difficult to determine which issues are related to the project and which are not. If in doubt, employees designated to receive grievances should accept the grievance and assess its legitimacy;
- Issues related to government policy and government institutions;
- Grievances constituting criminal activity and violence: In these cases, complainants should be referred to the justice system;
- Commercial disputes: Commercial matters should be stipulated in contractual agreements and issues should be resolved through a variety of commercial dispute resolution mechanisms or civil courts.

The specific objectives of the grievance mechanism is:

- ✓ To implement a tool for the correct management of external communications for the project.
- ✓ to evaluate and address stakeholders' problems and concerns regarding project activities.
- ✓ To establish a communication instrument with stakeholders based on a request, suggestions and complaints resolution mechanism to resolve social interest issues in a systematic, transparent and monitored manner.
- ✓ To permit stakeholders to submit requests, suggestions or complaints via free and easily accessible mechanism.
- ✓ To keep a record of the external communications that provide elements to identify areas of opportunity in how to manage community relations.

8.4.2 Steps in Managing Grievance Mechanism

A policy or process for addressing complaints cannot be effective if nobody knows about it. A company's grievance procedures should be put into writing, publicized, and explained to relevant stakeholder groups. Simply put, people should know where to go and whom to talk to if they have a complaint and understand what the process will be for handling it.

8.4.2.1 Publicising Grievance Management Procedures

The grievance mechanisms will be publicized in the following ways as a minimum:

- Posters at the site entrance; and
- Local authorities' site

- On the SEP disclosed online.

The information provided online and on posters will be available in all the relevant languages (i.e., Arabic and English) and will include at least the following:

- Who can raise grievances (i.e., all stakeholders).
- Where, when, and how community members can file grievances (to agree during the stakeholder engagement process).
- Who is responsible for receiving and responding to grievances.
- What sort of response complainants can expect, including the timing of response; and
- What other rights and protection are guaranteed.

In addition, specific measures have been included to ensure that grievances are reported (e.g. all vehicles dedicated full time for the project and circulating on roads outside the project site will have a clearly visible unique identification number and a sign with a telephone number for any road user to report grievances when required).

8.4.2.2 Submitting a Grievance

The grievance mechanism will allow for grievances to be filed, as a minimum, in the following ways:

- By post.
- By email and/or through an online form; and
- At the project gate.

Written and verbal grievances will be received at the project's gate – therefore the security personnel must be aware and trained to deal with the grievance appropriately. The security personnel should communicate that a stakeholder wants to submit a grievance to the person responsible to receive grievances. For illiterate complainants or those that prefer to submit their grievances verbally, the person responsible to receive grievances will meet them and will take notes on the details of the complainant and read them out loud to the complainant to confirm that the key elements of the grievance have been captured.

Table 134 : Grievance Recording Form

GRIEVANCE REGISTRATION	
Case No.:	Date:
Name:	
Department/ Contractor Name	
Phone no.	
Details of grievance:	
Name of person recording grievances (if applicable):	
Designation of recording person (if applicable):	
Proposed date of response to grievance:	
Signature of recording person (if applicable)	Signature of complainant
GRIEVANCE REDRESSAL RESPONSE	
Date of redresses:	
Decision of the responsible (give full details):	

8.4.2.3 Receiving Grievance

The responsible will commit to a certain time frame in which all recorded grievances will be responded and to ensure that this response time frame is enforced. This treatment process and response duration are 30 days. By letting people know when they can expect to be contacted by responsible and/or receive a response to their grievance their frustration may be reduced.

Each grievance thus received, shall be recorded in a grievance register. The format for the grievance register shall be as follows.

Table 135 : Grievance register

S. No	Date	Grievance Number	Name of Grievant	Department	Medium of Communication	Details of Grievance	Concerned Department	Name of Recording Person	Present Status	Remarks
1										
2										
3										
4										

8.4.2.4 Reviewing and Investigating Grievances

To ensure that all grievances are adequately investigated and closed out, a grievance log will be kept, documenting all the actions taken to address each grievance.

An extensive investigation may be required when grievances are complex and cannot be resolved quickly. The Administrative Head will take full responsibility for investigating the details of grievances coming through its grievance mechanism, following the principle of “no cost to communities”. Involving second parties during the investigation of grievances (i.e., The Project Company, the EPC, or subcontractors) when required is recommended.

In cases of sensitive grievances - such as those involving multiple interests and a large number of affected people - it may help to engage outside organizations in a joint investigation or allow for the participation of local authorities, only if the complainants agree to this approach.

For complex grievances, an investigation team will have to be appointed. If the investigation team is formed internally, issues that will be taken into consideration include potential conflicts of interest, qualifications, and budget.

Meetings with complainants and site visits can be useful for grievance investigation and will be undertaken, as appropriate.

8.4.2.5 Grievance Resolution Options and Responses

One of the potential advantages of a grievance mechanism is its flexibility. Rather than prescribe a specific procedure for each grievance, a list of possible options appropriate for different types of grievances are available. Options may include altering or halting harmful activities or restricting their timing and scope (e.g., for construction noise), providing an apology, replacing lost property, providing monetary compensation, revising the community’s engagement strategy, and renegotiating existing commitments or policies.

The solution to the grievance will be communicated to the grievant either in written format or verbally depending on what format the grievant has selected as preferred, but in all cases, a written record will be kept. In cases where the grievance/claim is rejected or where the administrative responsible does not require action, the company representative will be diplomatic when informing the grievant about the outcome of the eligibility review process to prevent conflict from escalating. Where the claim is accepted, a proposed solution will be provided and communicated to the grievant within a stipulated period. If the grievant does not accept the proposed resolution, the company would re-assess the situation, discuss, and clarify the finding with the grievant and make sure that all alternatives within the grievance mechanism are explored. If the grievant is still not satisfied with the proposed resolution, the grievant will be allowed to take the dispute resolution mechanism outside of the company grievance mechanism (an external mechanism).

Close-up monitoring of a grievance will be undertaken, if possible, by collecting proof that the necessary actions have taken place. For example:

- If the issue was resolved with the satisfaction of the complainants, get a confirmation and file it along with the case documentation.
- Take photos or collect other documentary evidence to create a comprehensive record of the grievance and how these were resolved.

Where the grievant is not satisfied with the outcome of the proposed resolution, actions concerning further discussion and re-assessment shall be completed and advised within two weeks of notification of dissatisfaction by the grievant.

8.4.2.6 Grievance Mechanism in Construction Phase

The construction phase will require two separate grievance mechanisms to be implemented for the following parties:

- Internal parties; Construction personnel, workers, project staff, (including subcontractors' staff and visitors);
- External parties.

Although the Project Company will remain responsible and accountable, the EPC Contractor will manage internal and external grievance mechanisms. A member of staff will be assigned the responsibility to receive and follow up on all grievances. They will also be required to train related staff. Grievances will be investigated by the EPC contractor and may require coordination with

the Ministry or other sub-contractors. All received grievances will be acknowledged within a week of receipt, or quicker depending on the urgency of the grievance.

Adequate resources will be allocated to the assigned staff member responsible for managing stakeholder engagement. This designated staff member will also be responsible for following up and managing grievances. An additional team or part of an existing team may support the member of staff; however, the staff will be experienced in engagement processes and will be familiar with the lender requirement for stakeholder engagement.

8.4.2.7 Grievance Mechanism in Operational Phase

The grievance mechanism in the operational phase of the project will be similar to that of the construction phase. The grievance mechanism will be available for both internal parties (site workers) and external parties.

A member of staff will be assigned and responsible for managing internal and external grievances received (recording, reviewing, investigating, and responding) appropriately.

Internal grievance forms will be made available in Arabic and English at key locations on-site with a sealed and locked 'post box' available for posting grievance at every location. The post box will be checked regularly.

External grievance forms will be made available in both English and Arabic at the site entrance gate. Sealed and locked 'post boxes' will be made available at the project site entrance for grievance form submission. The process for recording, reviewing, following up, and responding. All grievances during operations will be recorded for a minimum of 5 years, with records being kept on site.

8.5 Monitoring and Reporting process

8.5.1 Periodic Monitoring

The review and appraisal process in any project is an extremely important component for the smooth functioning and the avoidance of major risks within a project. The importance of the review process lies in the fact that it allows for the corrections of any oversight which may have been made during the initial stages of a project through mid-course corrections. This also serves as an important quality assurance mechanism.

The auditing process will seek to report good environmental practices as well as reporting non compliances where necessary. Non- compliances will relate to specific breaches of the applicable environmental & social standards/regulations or the site-specific environmental & social management plans.

The review process becomes more important when it is kept in mind that the SEP is a 'live document' or in other words a document that needs to be revised in a timely manner so as to make it comprehensive for any given period of time. This is so because of the fact that due to the life span of the project, it is difficult to properly identify and understand each stakeholder at the beginning of the project. The SEP thus requires regular reviews keeping in mind attributes such as the stakeholders, the engagement process for each stakeholder and the reporting time period for each.

8.5.2 Reporting

The initial years of Project construction and the Wind Power Plant implementation will witness a lot of flux in the profile of stakeholders identified and subsequently, the nature of their stakes may change. Additionally, the concerns and grievances of other stakeholders may also be more on account of the construction-related issues.

Thus, the performance of the SEP will be reviewed on a bi-annual basis during the initial years of SEP implementation. For the purpose of review, the quarterly reports will be considered for analysis and discussion. On the basis of these reports, a Stakeholder Engagement and Grievance Redressal Report will be prepared and disclosed biannually and annually, including a summary of issues raised by stakeholders, numbers, and subjects of grievances, a summary of key actions taken to address the concerns, analysis of trends and plans for engagement in the next time period.

8.6 Implementation plan

For the purpose of ensuring the proper and effective implementation of the SEP, the project will ensure that this engagement process is given as much importance as the other project activities and ensure the availability of the required resources. The following subsections discuss both these resource requirements and manpower.

In order to ensure the proper maintenance and functioning of the SEP, the project will make available human resources as required in the form of internal resources within the project as well as external resources or other third parties.

8.6.1 Internal Resources

The project will identify specific project personnel who are to manage the stakeholder engagement and grievance redressal process through the life of the project. These personnel will be part of the Environmental and Social Management Cell for the project.

8.6.1.1 Project Management Specialist

The Project Management Specialist (PMS) will be the person involved in day-to-day oversight and management of the project. In terms of SEP, the PMS will be the key party responsible to provide information on project updates and important decision-making aspects to the project steering committee and technical committees. Also, the PMS will provide guidance to all other staff in the implementation of this plan and other safeguards instruments.

Name	
Contact Details	

8.6.1.2 Environmental and Social Manager

To ensure that the project is implemented as per the environmental and social policies of the government, the project should employ an Environmental and Social Manager. The specialist will be responsible for:

- Identifying stakeholder environmental and social issues and acting appropriately to address those issues.
- Ensuring that the SEP and the available engagement methods are publicized by the Communications Specialist.
- Ensuring that project personnel are well briefed in regard to the SEP and grievance mechanism (including security personnel), and that the required resources (e.g. vehicles, company phones, office materials) are provided;
- Ensuring stakeholder meetings and disclosure of information are managed properly.
- Supervising the processing and resolution of all grievances; and
- Supervising the independent periodic monitoring and disclosure of the non-technical summary of the audit reports and of the full reports if required.

Name	
Contact Details	

8.6.2 External Resources

In case the internal resources at the project appear to be insufficient, the project will also consider engaging a reputed third party in the form of the organization familiar with the region and are acceptable to the community.

Table 136: Example of Grievance Register

S. No	Date	Grievance Number	Name of Grievant	Department	Medium of Communication	Details of Grievance	Concerned Department	Name of Recording Person	Present Status	Remarks
1										
2										
3										
4										

9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

The Environment and Social Management Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

EPC contractor is committed to implement an effective Environmental and Social Management System (hereinafter referred as ESMS) to continuously manage and communicate the potential social and environmental impacts and risks imposed on the project employees (direct and indirect) and maybe the existing communities in vicinity of the project. The outcomes of the Environmental and Social Impact Assessment of the project have been used to formulate an Environment and Social management & Management Plan, presented below. The Plan specifies measures for addressing the limited negative risks and impacts and for enhancing the beneficial impacts. In addition, organizational capacity and training requirements, required to check and ensure effectiveness of the plan throughout the lifecycle of the project, have also been discussed.

9.1 Training of Personnel & Contractors

EPC contractor should ensure that the job specific training and EHS Induction training needs are identified based on the specific requirements of ESMS and existing capacity of site and project personnel (including the contractors and sub-contractors). Special emphasis shall be placed on traffic management, stakeholder's engagement and grievance redressal. General environmental awareness shall be increased among the project's team to encourage the implementation of environmentally sound practices and compliance requirements of the project activities. This will help in minimizing adverse environmental impacts, ensuring compliance with the applicable regulations and standards, and achieving performance beyond compliance. The same level of awareness and commitment shall be imparted to the contractors and sub-contractors prior to the commencement of the project.

An environment and social management training program shall be conducted to ensure effective implementation of the management and control measures during construction and operation of the project. The training program shall ensure that all concerned members of the team understand the following aspects:

- Purpose of action plan for the project activities.
- Requirements of the specific Action Plans
- Understanding of the sensitive environmental and social features within and surrounding the project areas; and

- Aware of the potential risks from the project activities.
- A basic occupational training program and specialty courses shall be provided, as needed, to ensure that workers are oriented to the specific hazards of individual work assignments.
- Training shall be provided to management, supervisors, workers, and occasional visitors to areas of risks and hazards.
- Workers with rescue and first-aid duties must receive dedicated training so as not to inadvertently aggravate exposures and health hazards to themselves or their co-workers.
- Through appropriate contract specifications and monitoring, the employer shall ensure that service providers, as well as contracted and subcontracted labor, are trained adequately before assignments begin.

9.2 Monitoring

To implement the ESMP, the on-site team should adhere to a time-bound and action-oriented Environmental and Social Action Plan to implement the mitigation measures provided for each of the identified environmental and social impacts. This ESMP should be monitored on a regular basis, quarterly or half-yearly and all outcomes would need to be audited in accordance with existing EHS commitments.

The monitoring process should cover all stakeholders including contractors, laborers, suppliers and the local community impacted by the project activities and associated facilities thereby increasing the effectiveness of suggested mitigations measures. SBE should ensure that all the contractors comply with the requirements of conditions for all applicable permits, suggested action plans and scheduled monitoring. The inspections and audits should be carried out by an internal trained team and external agencies/experts. The entire process of inspections and audits shall be documented and key findings of which should be implemented by the proponent and contractors in their respective areas.

9.3 Documentation & Record Keeping

Documentation and record keeping system must be established to ensure updating and recording of requirements specified in ESMP. Responsibilities must be assigned to relevant personnel for ensuring that the ESMP documentation system is maintained, and that document control is ensured. The following records should be maintained at site:

- Documented Environment Management System;
- Legal Register;
- Operation control procedures;
- Work instructions;

- Incident reports;
- Emergency preparedness and response procedures;
- Training records;
- Monitoring reports;
- Auditing reports; and
- Complaints register and issues attended/ closed

9.4 Environmental and Social Management Plan (ESMP)

This section outlines the potential adverse impacts, 2mitigation measures, monitoring and management responsibilities during construction and operation phases of the Project.

The purpose of ESMP is to:

- Provide an institutional mechanism with well-defined roles and responsibilities for ensuring that measures identified in ESIA designated to mitigation potentially adverse impacts are implemented.
- List all suggested mitigation measures and control technologies, safeguards identified through the ESIA process.
- Provide Project monitoring program for effective implementation of the mitigation measures and ascertain efficacy of the environmental management and risk control systems in place; and
- Assist in ensuring compliance with all relevant legislations at local, state and national level for the Project.

Table 137 : Environmental and Social Management Plan

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means of verification and time/frequency of monitoring	Reporting Requirements
Construction Phase										
Land resources/soil	Construction of temporary structure, access road & internal access roads,	Permanent and temporary changes in land use	Impact on Land Use	Minor	•the After construction work, any land taken for a temporary basis for storage of material will be restored to their original form. •Existing roads widened and developed for access to the project site with the exception of a small connection from the Makkah-Riyadh highway to the plant site. •Construction activities should be restricted to designated area; •The land use in and around permanent project facilities should not be disturbed. •The construction activities will be restricted within the boundary of the proposed plant and will not alter the land use of the adjacent areas; •Proponent should take tree plantation program wherever possible in the plant boundary or along the access road side •Waste should not be allowed to litter in and around the project area; •On completion of construction activities, land used for temporary facilities will be restored to the extent possible; •The land should be restored back to the original state to the extent possible after completion of the life cycle of the project and in case there are plans not to continue further at the site.	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection Upon completion of work	Report from designated HSE personnel of EPC Contractor
	Site cleaning, leveling, compaction Civil construction activities	Impact on topography and drainage	Impact on topography and drainage	Minor	•The EPC contractor will be instructed to avoid any unnecessary changes in the topography. •Detail hydrology study should be carried out. •Appropriate number of cross drainage channels should be provided during access road construction to maintain flow in existing natural channels •Keep all natural channels to the extent possible at their original state •Design structures considering the natural functioning of the of drainage channels	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection Upon completion of work	Report from designated HSE personnel of EPC Contractor
		Impact on soil erosion and compaction	Impact on soil erosion and compaction	Minor	•The area to be cleared must be clearly demarcated and this footprint strictly maintained. •Soil conservation measures will be implemented such as stockpiling topsoil or gravel for the remediation of disturbed areas. •Scheduling activities (as far as possible) to avoid extreme weather events such as heavy rainfall and high winds; •Work areas will be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint; •It is recommended to grow turf grass beneath WTGs to avoid soil erosion •Construction vehicles will remain on designated and	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
					prepared compacted gravel roads;					
	•Maintenance of vehicles and heavy machinery •Storage of fuel and chemicals. Lubricating oil and other products	Soil contamination due to leaks and spills	Soil contamination leaks and spills	Minor	•Fuel, lubricating oil, and used oil storage areas will be contained in the bounded area. •Sewage generated from the project site will be treated and disposed of through septic tank and soak pits; •Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of. •Construction vehicles and equipment will be serviced regularly •The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals; •Surface run-off from bunded areas will pass through oil/water separators prior to discharge to the stormwater system; •A site-specific Emergency Response Plan will be prepared by the contractor for soil clean-up and decontamination. •Any loading and unloading protocols should be prepared for diesel, oil and used oil respectively; and •The construction contractor will implement a training program to familiarize staff with emergency procedures and practices related to contamination events	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor
	•Empty paint container disposal •Construction waste; Wooden crates, cartons, plastic wrapping sheets, wooden crates, cartons, plastic wrapping sheets from WTGs packaging •Municipal solid waste produced at the temporary site office •Hazardous materials and waste including oil, used oil, oil containing rags etc.; •Leakage/spillage from construction equipment and vehicles, DG sets and storage areas, •Improper disposal of sewage; •Improper disposal of used lubricating oils and other used oils •Improper disposal of domestic waste	Soil contamination waste generation	Soil contamination waste generation	Minor	•The construction contractors will have control over the amount and types of waste (hazardous and non-hazardous) produced at the site. Workers will be strictly instructed about random disposal of any waste generated from the construction activity; •Construction contractor should ensure that no unauthorized dumping of used oil and other hazardous wastes is undertaken from the site; •Municipal domestic waste generated at site to be segregated onsite; •Ensure hazardous waste containers are properly labelled and stored onsite provided with an impervious surface, shed and secondary containment system; •Ensure routinely disposal of hazardous waste through approved vendors and records are properly documented; •Construction contractor should ensure daily collection and periodic (weekly) disposal of construction waste generated debris, concrete, metal cuttings wastes, waste/used oil etc.; •Ensure hazardous waste is properly labeled, stored onsite at a location provided with impervious surface, shed and secondary containment system and; •The municipal waste from the labor camp will only be routed through proper collection and handover to the local municipal body for further disposal. The hazardous wastes will be temporarily stored in labeled drums on the impervious surface at designated area onsite and will be disposed of through approved vendors.	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor
water resources	Water demand for construction work	Impact on surface water availability	Impact on surface water availability	Moderate	•Construction labor deputed onsite to be sensitized about water conservation and encouraged for optimal use of water;	minor	EPC Contractor HSE Manager	NCEC Supervisor	Permission letter (Monthly	Report from designated HSE personnel

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means of verification and time/frequency of monitoring)	Reporting Requirements
	Water demand for sanitary blocks				- Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers is necessary for efficient utilization of water; - It should be ensured that water supply for the Project to be procured from approved suppliers and the approval copy of the same to be maintained to ensure the right source; - Blending of low-quality water with fresh water for construction uses to ensure efficient use of natural resource. - Recycling/reusing to the extent possible - Use to extent possible wet technology for cleaning equipment to optimize the consumption of water - Implement if possible a system to treat and reuse the wastewater					of EPC Contractor
	- Sewage from labor camp - Liquid effluent from washing of equipment and vehicles - Storage of hazardous waste onsite	Surface Water contamination by spills /leaks	Contamination by spills /leaks	minor	- Fuel, oil and used oil storage areas will be contained in bunds of 110 percent capacity of the stored material. - Refueling will be carried out in designated areas using strict protocols. - Spill containment and clean up kits will be available on-site and clean-up from any spill will be appropriately contained and disposed of at a bound landfill site. - Project staff will not be permitted to utilize any water sources (stream, river, or other water bodies) for the purposes of bathing, washing of clothing. - Construction vehicles and equipment will be serviced regularly at off-site location. - Ensure that all construction plant and equipment is maintained in a good state of repair with minimal leaks. - Oil leakage or spillage will be contained and cleaned up immediately. Waste oil will be collected and stored for recycling or disposal. - Oil and grease separator shall be used for wastewater generated from cleaning activities. - Adequate sanitary facilities, i.e. toilets and showers, will be provided for the construction workforce; - Workers will be trained in the use of designated areas/bins for waste disposal and encouraged to use toilets. - Septic tanks will be provided to treat sanitary wastewater - Use of licensed contractors for management and disposal of waste and sludge and - All sewage and liquid effluent will be treated to meet the standards specified by the MEWA regulations and IFC guidelines EHS 2007	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor
	Earthworks in the project area may increase the erosion, especially during rainfall events, which may increase the suspended sediment concentrations and pollute water sources;	Surface water Contamination by loads of sediments	Contamination by loads sediments	minor	- The drainage pattern of the site will not be altered, and the natural slope of the site will be maintained. - Special care needs to be taken during the road construction to maintaining the standard slop as the soil cannot wash out in the water body. As well as need proper compaction of the road structure. - Cover all slopes of the road by first growing grass. - Adequate arrangement for stormwater management during construction period will be made to avoid sediment runoff from the site.	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
	- Improper disposal of sewage and wastewater from labor camp and construction debris - Unplanned event such as leaks and spills of oil, lubricants, fuel from heavy equipment	Impact on groundwater quality	Impact on groundwater quality	Minor	- Fuel, lubricating oil, and used oil storage areas will be contained in the bounded area. - Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of. - Construction vehicles and equipment will be serviced regularly - The Contractor will prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals; - Surface run-off from bunded areas will pass through oil/water separators prior to discharge to the stormwater system; - A site-specific Emergency Response Plan will be prepared by the contractor for soil clean-up and decontamination; - Any loading and unloading protocols should be prepared for diesel, oil and used oil respectively; and - The construction contractor will implement a training program to familiarize staff with emergency procedures and practices related to contamination event	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (monthly monitoring)	Report from designated HSE personnel of EPC Contractor
Ambient air quality	- Dust generation from earthworks such as leveling, grading, excavation works and movement of vehicles across dirt/unpaved roads, especially during windy conditions - Construction of access road - Construction of foundation of supporting structures of WTGs - Construction of building, loading and unloading equipment - Dust generated from stockpiles of waste, topsoil handling and moving excavated material and transporting wastes on vehicles	Impact on air quality by dust generation from construction	Dust from construction	Moderate	- Implementation of a regular watering and sprinkling dust suppression regime, during the dry season. - Stockpiles of dusty materials will be enclosed or covered by suitable shade cloth or netting to prevent the escape of dust during loading and transfer from Site. - No stockpiles will be maintained outside, and maximum Possible distance between the stockpiles and receptors will be maintained. - Covering and/or watering of all stockpiles of dusty materials such as excavated spoils to avoid fugitive dust emissions. - During construction, the approach road will be kept clean, free from mud and slurry. - Material transport will be totally enclosed with impervious sheeting and wheel washing will be carried out at site. - Speed of vehicles on site and approach road will be limited to 15-20 km/hr which will help in minimizing fugitive dust emission due to vehicle movement - Idling of vehicles and equipment will be prevented and - Waste from construction will not be burned. - Concrete, sand and aggregates shall be stored as far from sensitive receptors as possible and screened/shielded if they are located within 100m of sensitive receptor. - The distance from receptors to dust emission sources (stockpiles etc) shall be maximized, with consideration of prevailing wind direction. - Dusty materials shall be removed from construction sites as soon as possible. - Transport of contaminated soil (if any) shall also be carried out with tight fitting covered trucks or closed containers. - Loaded trucks to or from the work site area shall avoid heavily travelling through residential roads in the localities around.	Minor	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means of verification and time/frequency of monitoring	Reporting Requirements
					- Traffic management measures shall reduce congestion: Planning of driving construction vehicles outside of the construction area during rush hour traffic. - Implementation of a Dust Control Plan					
	- Exhaust emission from operation of machinery like pile drivers, vehicles - Point source emission from diesel generator - Vehicular emissions due to increased traffic movement on site and on the approach roads - Operation of heavy equipment	Air pollution by Exhaust/fugitive emission	Exhaust/fugitive emission	Minor	- The movement of construction vehicles will be minimized, and a 20 km/hr speed limit will be enforced in the project site as well as approach road; - Vehicles traveling on gravel roads will not exceed a speed of 30 km/hr; All diesel-powered equipment will be regularly maintained and idling time reduced to minimize emissions; - Low sulfur diesel (S<0.5%) will be used in diesel-powered equipment in collaboration with best management practices; - Vehicle/equipment air emissions will be controlled by good practice procedures (such as turning off equipment when not in use); - Vehicle/equipment exhausts observed emitting significant black smoke in their exhausts will be serviced/ replaced; and - Implementation of an Engine Emission Management Program; - Solid waste burning in the project site is strictly prohibited	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor
Ambient Noise	- Construction activities - Transportation of construction materials, plant materials, machinery and personnel - Operation DG sets; - Operation of batching plant - Digging of trenches to accommodate underground power cables,	Ambient noise level increasing	Impact on ambient noise	minor	- The contractor should ensure that all construction equipment and vehicle is fitted with silencers (where possible); - The contractor should consider the noise emission characteristics of equipment when selecting equipment for the project and select the least noisy machine available to perform the specific work (this is a requirement of OSHA 2007); - The contractor should undertake additional post development noise monitoring in accordance with National and International noise standards. - Mobile noise sources such as cranes, earth moving equipment shall be routed in such a way that there is minimum disturbance to receptors; - Developer shall instruct their Safety Officers to arrange for inherently quiet construction equipment and machines to maintain the noise level to minimum; - Only limited construction activities shall be carried out during night-time; - Restrict the night time vehicle movement through the access road; - Adopt the vehicle speed limit in the access road	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel of EPC Contractor

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
					•It is also to be ensured that no village road will be utilized for movement of equipment except the designated access road; •The number of equipment operating simultaneously should be reduced as far as practicable; •Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby NSRs as far as practicable; •All loud and sudden noises will be avoided wherever possible and fixed noise sources shall be located at least 50m away from the site boundary; •Rubber padding/noise isolators will be used for construction equipment •Temporary noise barriers shall be provided surrounding the high noise generating construction equipment; •The personnel involved in high noise generating activities shall be provided with personal protective devices to minimize their exposure to high noise levels; •Construction vehicles and machinery will be well maintained and not kept idling when not in use					
Traffic and Transport	Transportation of construction materials, plant materials, machinery and personnel	Increasing of traffic level	Impact on traffic and transport	Moderate	•The contractor should ensure that all WTGs and mounting structure components are transported in appropriate vehicles that adhere to the axle load limits. •Only trained drivers with valid license shall be recruited by the construction contractor. •Training programs shall be conducted at regular intervals for all the drivers for raising awareness about road safety and adopting best transport and traffic safety procedures once in every month. •Additionally, speed limits for all construction related vehicles shall be adhered to at all times to prevent damage to roads and other infrastructure •Mitigation measures such as emphasizing on safety amongst drivers, adopting limits for the trip duration and arranging driver roster to avoid overtiredness and avoiding dangerous routes and times of day to reduce the risk of the accident shall also be implemented. •High visibility colors should be used during the transportation of WTGs to the project site. •Regular maintenance of vehicles and use of manufacturer approved parts should be adopted to minimize potentially serious accidents caused by equipment malfunction or premature failure. •The villagers will be made aware of the schedule prior to the movement of trucks and transportation of power plant equipment in the project area. •Collaboration with local communities and responsible authorities to improve signage, visibility, and awareness of traffic and pedestrian safety; •Notify the governing body and local area responsible person prior to start the construction work and put adequate signage around the construction area on both way and instruct the driver for carefully driving in close to the	Minor	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (daily monitoring)	Report from designated HSE personnel of EPC Contractor

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
					sensitive area; •Coordination with emergency responders to ensure that appropriate first aid is provided in the event of accidents. •The existing earthen road should keep functional as the local people can use the road; •Movement of the project traffic should be limited to the planned route only and; •The traffic movement in the settlement areas should be limited for the daytime only					
Ecology and ecosystem	•Project site clearance; •Project site leveling; •Construction activities at site	on terrestrial flora and fauna,	Impacts on ecology and biodiversity	Minor	•Should as part of the Project any fencing be erected, it must be ensured that it allows for the natural movement of small faunal species within the area. This could include for example a fence with an appropriate gap between the ground level and the first rail or strand (around 30 cm). •One major modification that could take place at the project site is the removal of the trees. The trees are believed to be of significance for the biodiversity elements at the Project Site especially the birds. Therefore, the minimum number of trees should be removed from the project site in order to achieve the minimal impact possible on the biodiversity at the Project Site. The trees removed should be replaced by other trees to be planted in the vicinity of the project site in order to act as an offset for the removed trees and as a new refuge for the species affected. •Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising/training of personnel and good housekeeping which include the following: •Prohibit hunting at any time and under any condition by construction workers onsite. •Ensure proper storage, collection, and disposal of waste streams generated. •Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances. •Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures.	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	•Site Inspection •Training records •Visual assessment by experts •(One-time monitoring during start of project activity and quarterly once monitoring)	Report from designated HSE personnel of EPC Contractor
Occupational Health and Safety Hazard	• Accidents and injurie associated with the operation of heavy machinery and other construction activities. • Health impacts associated with environmental conditions and changes in environmental quality, arising from emissions of air, water pollution and noise generation from	Health risk of the worker	impact on occupational health and safety	Moderate	•The workers (both regular and contractual) on the project will be provided with training on the Health and Safety policy in place, and their role in the site and refresher courses will be provided throughout the life of the project. •Establish a grievance redressal mechanism in place, to allow for the employees and workers to report any concern or grievance related to work activities. •Operation of loading-unloading equipment should be undertaken under the guidance/supervision of trained professional. •The contractor should ensure that no person is engaged in driving or operating construction machinery unless he is sufficiently competent and reliable, possess the knowledge of risks involved in the operation and is medically	Minor	EPC Contractor HSE Manager	NCEC Supervisor	•Site Inspection •Training records •Visual assessment (Monthly Monitoring)	Monthly progress report from designated HSE personnel

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
	construction activities as well as from storage and handling of waste, particularly hazardous waste. • Loading and unloading activities of the construction materials • Working at height, working with rotating machinery and falling objects				examined periodically. •Contractor should prepare a site Emergency Preparedness and Response Procedure, which should be followed for the subjected project. •Adequate training should be provided to staff about raising awareness about use of Personal Protection Equipment (PPE) and emergency response measures; •Job responsibility and shifting chart should be prepared so that no person shall be over exhausted, which will ultimately lead to the accident or injuries; •Safety sign should also be marked at appropriate places. •It shall also be ensured that good housekeeping at the construction site is maintained to avoid slips and falls. •Excessive waste debris and liquid spills will be cleaned up regularly, while electrical cords and ropes will be placed along identified corridors marked for the attention of everyone at the site. •Use of personal fall arrest system, such as full body harnesses as well as fall rescue procedures to deal with workers whose fall has been successfully arrested shall also be carried out. •Dropping/lowering of construction material or tool will be restricted and undertaken only under strict supervision if required. PPEs such as safety glasses with side shields, face shields, hard hats and safety shoes shall be mandatory at a construction site. Earplugs shall be provided for workers placed in high noise areas.					
Socioeconomic aspect	• Traffic level increases due the project construction activities • Solid waste improper disposal and scattered around site • Improper handling of wastewater and other hazard waste that may causes diseases in the communities close to project	Inconvenience of communities in vicinity of the project and community health and safety issue	impact on community health and safety	Minor	<u>for traffic</u> •The truck drivers carrying construction machinery and materials will be instructed to drive within speed limits with careful consideration for villages traffic in vicinity. •Movement of heavy equipment and construction materials will be regulated during peak hours (09:00 AM to 06:00 PM). •Proper route of movement of project vehicles will be identified. •Depute traffic escorts as and when required near project site and major settlements to guide movement of project vehicles. •Keep limited speed of project vehicles near settlements and within the project site. •Provide necessary training to the drivers for speed restrictions and on do's and don'ts. <u>For waste management and disposal</u> •The excavated areas will be properly fenced for safety and sign boards in local languages will be put up; •No hazardous waste or any waste be stored within the site for long periods of time and be in contact with the soil. •The quantity of domestic waste generated daily from the labor camps will be small and limited as most of the workers will be hired locally. However, the construction contractor shall ensure that the camp sites provided at the site have adequate waste disposal facilities. Arrangements	Negligible	EPC Contractor HSE Manager	NCEC Supervisor	Site inspection (daily monitoring)	Monthly progress report from designated HSE personnel

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
					for collection of garbage in dustbins and daily disposal to the nearest dump site shall be made. Provision of toilets for workers shall be made at the campsites in order to maintain hygienic and clean surroundings. •Effort should be made to use the locally available labor for unskilled work purpose. •Construction contractor will be followed the 3R policy to manage the solid waste management. •Nearby municipality may also be contracted for regular disposal of the labor camp waste. •Washing and bathing areas will be provided with a proper drainage system so that wastewater is not accumulated in the campsites. Disposal of sewage shall be made through a septic tank – soak pit arrangement. •Used or waste oil generated from generators and construction machinery and equipment will be stored on a paved surface in a secure location at the project site. Appropriate secondary containment capable of containing the 110 percent of the largest tank is to be provided. •The waste oil, which is characterized as hazardous will be sold to authorized vendors at frequent intervals. •Empty fuel containers will also be stored at a secured area designated for scrap and sold to authorized vendors. All packaging material will also be collected at the storage area and sold to scrap dealers. •Construction debris and excavated material will be stored in a confined area to prevent spread by wind or water. •The construction debris will be used for backfilling of excavated areas and for foundation works at site					
	Creation of employment opportunities	Impact on community by job opportunities creation	impact on employment	Positive	•The local community is preferred by the project for the requirement of skilled, semiskilled and unskilled workers to the extent possible. •The sourcing of local labor wherever possible should be made obligatory for the sub- contractors and in all major procurement activities. •Preference should be given to the vulnerable population. •The EPC Contractor/ and the MoE/MEWA will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labor and resources.	Positive	EPC Contractor	MoE/Ministry of human resources and social development		
	Migrants workers hired for the project may have issue with the local residents and may transmit infectious diseases	impacts from migrants workers (social impacts, spreading of infectious disease.)	impacts from migrants workers (social impacts, spreading of infectious disease.)	Minor	•Engage as many locally available unskilled, semi-skilled and skilled human resources as practically possible to avoid large scale in migration of labor force. •Provision of infrastructure and amenities for migrant labor in construction camp to avoid dependence on limited local resources. •Adequate sanitation facility at labor camps to maintain hygiene and minimize spread of diseases. •Creating awareness about local tradition and culture among outside migrant and encouraging respect for same. •Providing awareness training regarding infectious diseases among the migrant population. •Proper disposal of wastes generated from the camp and construction activity to maintain general hygiene in the	Negligible	EPC Contractor designated person	Person designated from Ministry of human resources and social development/Person designated from Ministry of health		

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
					area. • Avoid unnecessary movement of vehicles through near settlement areas to avoid disturbance and traffic safety related issues					
Operation and Maintenance Phase										
Soil environment	- Monitoring of wind power plant operation; - Routine maintenance activities at WTGs - Material handling and storage - Hazardous and Non-hazardous material and waste management	Soil contamination due to accidental spills leaks	Soil contamination due to accidental spills leaks	Moderate	- Ensure oil/ lubricants are stored on impervious floor in the storage area having secondary containment. - Use of spill control kits to contain and clean small spills and leaks during O&M activities; and - The guidelines and procedures shall be prepared and followed for immediate clean- up actions following any spillages.	Minor	O&M Contractor HSE Manager	NCEC Supervisor	Site inspection (Monthly monitoring)	report from designated HSE personnel
		Soil contamination due to improper waste disposal	Improper Waste Disposal		- The waste generated during operation phase will be disposed of through approved vendors; - The hazardous wastes will be stored onsite at separate designated covered area provided with impervious flooring and send for disposal to nearest designated dumping site; - During the operation phase, the quantity of municipal waste and hazardous waste generated is less and probability of the hazardous waste generation is only during maintenance and therefore occasional. The waste generated would be routed through proper collection and containment. - The water for cleaning purpose of the WTGs remove dust from it is likely to get evaporate or absorbed by the vegetation and soil underneath the WTGs; - The Operator/Contractor should make a MoU (Memorandum of Understanding) with the local municipality to collect the daily domestic for disposing of in the designated dumping site.		O&M Contractor HSE Manager	NCEC Supervisor	- Internal audit - Site inspection (Monthly monitoring)	Report from designated HSE personnel
Waste generation aspect	- Wastes likely to be generated during routine operations are dielectric fluids, clearing agents and solvents etc; - Repair and maintenance of underground cables and associated utilities will lead to generation of hazardous wastes as used oils - Wastewater from WTGs cleaning; - Waste from spare parts of WTGs will be generated; - Domestic liquid and solid waste	Contamination of soil, surface and groundwater	Waste generation	Moderate	- The separate designated area should be earmarked for storage of hazardous waste like waste oil, transformer oil. These wastes shall be given to the MoE approved recyclers. - Operation waste management will be governed by an Environmental Management Plan (EMP) and will incorporate reduction, recycling, and reuse principles. - Material Safety Data Sheets for all applicable materials present on Site will be readily available to on-site personnel. - All wastes produced from project activities on site will be transferred to designated temporary storage areas and where possible into secure containers. - Solid wastes will be segregated to facilitate reuse and recycling of specific materials. - All wastes that cannot be reused or recycled will be collected by approved waste contractors and transferred to an appropriately licensed waste management facility for treatment and disposal. - First of all, inspection of WTGs parts for defects that can appear in the form of burn marks, discoloration, or broken	minor	O&M Contractor HSE Manager	NCEC Supervisor	- Internal audit - Site inspection (Monthly monitoring) - Site inspection and record	Report from designated HSE personnel

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					glass is to be undertaken. An authorized person will walk the site to confirm that there are no broken spare parts should not be sprayed with water. •Broken or damaged WTGs parts are required to be immediately shifted to a designated area in a scrap yard to avoid any type of land contamination. A photograph is to be taken of the broken WTGs parts at the site to cater to Insurance settlement claims. •Once the WTGs parts have reached the end of their life cycle, the manufacturer of the WTGs will collect and recycle the WTGs and recover any hazardous substances in the WTGs. This provision forms part of the supply agreement between the proponent and the selected WTGs manufacturer. • Use the soak pit and septic tank in the office building and guard room for sewage.					
Water resources	• Water use for WTGs cleaning; • Water Consumption for domestic use; • Possibility of groundwater level reduction due to compacted soil and covered by WTGs • Surface water pollution due to the surface runoff from the project to the drainage network passing through the project • Surface and groundwater pollution due to the accidental leakage and spills of oil	Impact on Water availability	Water availability	moderate	•variability and projected changes in demand in the Project area; •Periodical training should provide to workers for best utilization of water; •Bore-wells should be established, if deep aquifer is available is after requisite permission from the regulatory authority. Meters should be installed at the bore-wells to monitor the abstraction of water; this option proposed should be studied and assessed in advance. •Wastage of water during cleaning of Turbines should be avoided; otherwise opt for dry cleaning technology. It would save considerably water. •Drinking water demand should be met by bottle potable water purchased •The wastewater emanating from cleaning operations shall be used for the irrigation of green spaces in project area. Wastewater reused should be in compliance with the Saudi regulations on wastewater reuse. and excess water shall be discharged after settling of the sediment. •Appropriate drainage network should be planned in the project site;	Minor	O&M Contractor HSE Manager	NCEC Supervisor	• Visual Inspection • Records of water consumption (daily Monitoring)	Report from designated HSE personnel
	Improper disposal of wastewater	Impact on water quality	Water quality	minor	•The drainage and sewerage system will be provided for the collection and treatment of wastewater at SCADA building/ CMS and substation areas by establishing a septic tank or portable Wastewater Treatment plant (WWTP). This Alternative (WWTP) could allow to reuse the treated wastewater in compliance with Saudi Regulations for Wastewater treatment and reuse and it could save water. The better choice between the two alternatives should be the object of a technical and economic study •No wastewater discharge on open land will be practiced; •The plant site should be provided with adequate drainage facility to drain-off the rainy water and prevent any waterlogging at site or in the surroundings; •No careless attitude in the handling of hazardous waste and oil should be tolerated during plant operation. If any oil spilled out accidentally, it should be cleaned and stored appropriately.	negligible	O&M Contractor HSE Manager	NCEC Supervisor	• Visual Inspection • Records of water quality (daily Monitoring)	Report from designated HSE personnel

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
					Fuel, oil and used oil storage areas will be contained in bunds of 110% capacity of the stored material.					
Air Quality	- Maintenance of Vehicles - Transportation during operation and maintenance of the power plant	Air pollution	Air quality	minor	- Vehicles traveling on gravel roads should not exceed a speed of 30 km/hr. - Regular water spray is required on unpaved road as the dust not move during heavy wind; - Use clean fuel in vehicle as the exhaust emission will be low	Negligible	O&M Contractor HSE Manager	NCEC Supervisor	- Visual Inspection - Records (Monthly Monitoring)	Report from designated HSE personnel
Ambient Noise	- Vehicles movement - Noise from inverters and transformer - Repair and Maintenance Works of WTGss	Increase of noise level	Impact on Ambient Noise Levels	minor	- Periodic maintenance of machinery and vehicles used on the site. - Inverters and transformers should be well maintained and provided by noise reduction system. (noise barriers, sound absorbing noise barriers ..) - Periodic monitoring of noise near to the sources of generation, like transformers, to ensure compliance with design specification.	negligible	O&M Contractor HSE Manager	NCEC Supervisor	- Daily inspection - Records (Monthly monitoring)	
Ecology and ecosystem	- Electrocution from transmission line; - Hunting of mammals and avifauna - Increased risk of fires at the site due to failure of machinery or transmission line - Poisoning animals by hazards waste	Impact on Ecology and biodiversity	Impact on Ecology and biodiversity	minor	- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising/training of personnel and good housekeeping which include the following: - Prohibit hunting at any time and under any condition by workers onsite. - Ensure proper storage, collection, and disposal of waste streams. - Restrict activities to allocated areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances. As per monitoring and reporting requirements during operation phase the Project Operator should inspect the works at all times.	Negligible	O&M Contractor HSE Manager	NCEC Supervisor	- Site Inspection - Training records - Visual assessment by experts (Quarterly monitoring)	Report from designated HSE personnel
Landscape and visual	Setup of WTGs	Visual impact due to glare	Landscape and Visual Impact	minor	- The WTGss will be installed at a low height and will be kept closer to the ground so that it does not prop out of the general landscape of the area; - The Turbines will be arranged in a systematic manner which will give an aesthetic sense to it; - The proposed wind power project would include a boundary wall around the perimeter of the project to further obscure the peripheral view of the project and any indirect reflection. Impacts from glare would be minor; - All cables and power lines will be located underground as far as possible; - The substation, gatehouses and maintenance and storage buildings will be grouped as far as possible to avoid the scatter of buildings in the open landscape. - The design of the buildings will be compatible in scale and form with the building style of the region. - All yards and storage areas to be enclosed by masonry walls or screens; - External lighting will be confined to the substations and maintenance areas. Lights will be low-level and fitted with reflectors to avoid light spillage. - Signages related to the enterprise are to be discrete and	Negligible	O&M Contractor HSE Manager	NCEC Supervisor	Internal audit and record (Daily Monitoring)	Report from designated HSE personnel

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					confined to the entrance gates. No other corporate or advertising signage, particularly billboards or flags, to be permitted; •All lighting will be kept to a minimum within the requirements of safety and efficiency; •Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce light spillage and pollution, will be used; •No naked light sources will be directly visible from a distance. Only reflected light will be visible from outside the Site; •External lighting will use down-lighters shielded in such a way as to minimize light spillage and pollution beyond the extent of the area that needs to be lit; •Security and perimeter lighting will also be shielded so that no light falls outside the area needing to be lit. Unnecessarily tall light poles are to be avoided; •Warning signs at appropriate distances indicating Wind Power plant location should be placed to alert road users.					
Occupational health and safety hazards	• Leaching of materials from broken or fire damaged WTGss • Vehicle accidents, replacement of components/parts - Emergency Fire Hazard • Electrocution of workers • Electromagnetic radiation from WTGss	Health risk of the worker	Occupational Health and Safety	Moderate	•Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears. •Adequate training regarding health and safety will be provided to the workers. •A health, safety, and environment (HSE) management system will be developed, rolled out and implemented. This system which will be reviewed annually or after a major accident or incident •The switchyard building will be provided with fire extinguishers and sand buckets at all strategic locations to deal with any incident of fire. •Safety incidents will be recorded and monitored with an aim that numbers are never significant, and gradually reduce. •Workers at site handling broken WTGss shall be provided with adequate PPEs (safety gear, goggles, and gloves). •The workers at the site are also on regular basis shall be appraised about the potential health risks associated with the handling of WTGss. •Ensure use of safety belt and need for safety net as required; •All work at height to be undertaken during daytime with sufficient sunlight except emergency (with proper illumination arrangement); •Fixtures shall be installed on tower components to facilitate the use of fall protection systems; •Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment shall be engaged for work at height; •Workers handling electricity and related components will be provided with shock resistant gloves, shoes and other protective gears. Adequate training regarding health and safety will be provided to the workers; •Access to areas containing exposed electrical equipment	Minor	O&M Contractor HSE Manager	NCEC Supervisor	Internal audit, meeting with technical and other staff and record (Monthly Monitoring)	Report from designated HSE personnel

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means verification of time/frequency of monitoring	Reporting Requirements
					(such as transformers) shall be fenced and locked. Warning signs shall be posted at hazardous locations; •Firefighting equipment such as fire extinguishers and sand buckets shall be provided at appropriate locations; •Workers involved in electric operations shall be provided with Protective Equipment such as rubber gloves etc; •Employees involved in electrical works shall be trained in and familiar with the safety- related work practices, safety procedures, and other safety requirements that pertain to their respective job assignments. •First aid box/ arrangement to be ensured					
Traffic and transport	Bringing to the site special loads of WTGss, structures that will make inconvenience to the road users	Impact on traffic and transport	Traffic and transport	Negligible	•During operation, if abnormal loads are required for maintenance, the appropriate arrangements will be made to obtain the necessary transportation permits and the route agreed with the relevant authorities to minimize the impact of other road users.	Negligible	O&M Contractor HSE Manager	NCEC Supervisor	Site inspection (daily monitoring)	Report from designated HSE personnel
Renewable energy / NREP implementation	Setting up renewable energy Power plant	Positive impact	Impact on climate change	Positive		Positive				
Socioeconomic aspect	New employment opportunities for long-term	Positive impact	Impact on employment	positive	•The local community is preferred by the project for the requirement of skilled, semiskilled and unskilled workers to the extent possible. •The sourcing of local labor wherever possible should be made obligatory for the sub- contractors and in all major procurement activities. •Preference should be given to the vulnerable population. •The EPC Contractor/ and the MoE/MEWA will establish a mechanism to audit subcontractors and suppliers with respect to compliance of utilizing local labor and resources.	Positive	Person designated from O&M Contractor	Person designated from MoE/Ministry of Human resources and social development		
Decommissioning phase										
Soil Environment	Dismantling of WTGs Structure Restoration of site to its initial state	Soil contamination	Impact on soil environment	minor	•The decommissioning of the Wind Power plant will be carried out in a planned manner. •During decommissioning phase, the quantity of waste generated will be high. The waste will be routed through proper collection, storage and disposal. The waste will be evaluated for its recycling/ reuse/ scrap value and disposed accordingly. •The vehicular movement during decommissioning activities should be restricted to the designated route path; •The demolition/ dismantling waste should not be left over in the project area and to be collected and stored at designated area only for further segregation and disposal.	minor	Decommissioning Contractor	NCEC Supervisor	Site inspection (Monthly monitoring)	Report from designated HSE personnel
	Wastewater disposal Solid waste disposal	Water contamination	Impact on Water Environment	minor	•The provisions of septic tank and soak pits will be provided onsite for treatment and disposal of sewage, thereby minimizing the impacts of wastewater discharge. Planning of toilets, soak pits and septic tanks, waste collection areas should be away from natural drainage channels; •Use of licensed contractors for management and disposal of waste and sludge; •Spill/ leakage clearance plan to be adopted for immediate cleaning of spills and leakages; •Water tankers with proper permissions will be utilized for water sourcing.	negligible	Decommissioning Contractor	NCEC Supervisor	Visual inspection Audit (daily monitoring)	Report from designated HSE personnel

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means of verification and time/frequency of monitoring	Reporting Requirements
					•Ensure proper cover and stacking of loose construction material to prevent surface runoff and contamination of receiving water body; •Laborers will be given training towards proactive use of designated areas/bins for waste disposal and encouraged for use of toilets. Any random disposal of sewage shall be strictly restricted; •Construction labor deputed onsite to be sensitized about water conservation and encouraged for optimal use of water; •Regular inspection for identification of water leakages and preventing wastage of water from water supply tankers. •Recycling/reusing to the extent possible.					
Ambient air quality	Dismantling of WTGs Restoring land	Air pollution	Impact on air quality	Negligible	•Emissions from the emergency DG set and other stationary machines will be controlled by ensuring that the engines are always properly tuned and maintained. •Minimize stockpiling by coordinating excavations, spreading and restoring land activities. •Speed of vehicles on site will be limited to 10-15 km/hr which will help in minimizing fugitive dust emissions due to vehicular movement •A dust management plan should be applied •Idling of vehicles and equipment will be prevented. •Burning of any waste material shall be prevented. •Laborers shall be provided with natural gas connection to prevent burning of fuel wood for cooking or heating purposes. •Work shall be ceased or phased down if excess fugitive dust is observed. Source of dust shall be investigated, and proper suppression measures ensured. •Proper maintenance of engines and use of vehicles well maintained shall be ensured. •WTGs parts should be handled properly to do not be damaged on site	Negligible	Decommissioning Contractor	NCEC Supervisor	Visual inspection Records (monthly monitoring)	Report from designated HSE personnel
Ambient Noise	Dismantling WTGs Restoring land Using of rotary cutting machines	Impact on ambient noise level	Impact on ambient noise	minor	•Normal working hours of the contractor to be defined (preferable 8 am to 6pm). If work needs to be undertaken outside these hours, it should be limited to activities which do not generate noise. •Only well-maintained equipment should be operated on-site; •If it is noticed that any particular equipment is generating too much noise then lubricating moving parts, tightening loose parts and replacing worn out components should be carried out to bring down the noise and placing such machinery far away from the households as possible. •Machinery and equipment that may be in intermittent use should be shut down or throttled down during non-work periods; and •Minimal use of vehicle horns and heavy engine breaking in the area needs to be encouraged.	negligible	Decommissioning Contractor HSE Manager	NCEC Supervisor	• Daily inspection • Records (Monthly monitoring)	Report from designated HSE personnel
Socioeconomic aspect	Loss of jobs Issue with employees when let them to leave	Impact on employment and community	Impact on employment and community	Minor	•O&M Contractor should ensure that retrenchment packages are provided for all staff who stand to lose their jobs when the plant is decommissioned.	negligible	O&M Contractor designated person	Person designated from MoE/Ministry of Human		

Project Stage/ Affected Aspect	Project Activity	Potential impact	Potential Impact	Significance (Pre- mitigation)	Mitigation measures /Enhancement	residual significance (Post- Mitigation)	Responsibility for mitigation implementation	Responsibility for supervision of mitigation implementation	Means of verification and time/frequency of monitoring	Reporting Requirements
					•The contractor shall inform the workers about the duration of work; •Reduction of worker will be done phase wise and corresponding to completion of each activity; and •All waste generated from demobilization shall be collected and disposed of at the nearest municipal disposal site.			resources and social development		
Occupational health and safety	Risks associated with health and safety issues such as trip and fall, electrical hazard etc.;	Impact on occupational health and safety	Impact on occupational health and safety	Moderate	•The workers of decommissioning phase will be provided with training on the Health and Safety policy in place, and their role in the site and refresher courses will be provided throughout the life of the project. •Operation of loading-unloading equipment should be undertaken under the guidance/supervision of trained professional. •The contractor should ensure that no person is engaged in driving or operating dismantling machinery unless he is sufficiently competent and reliable, possess the knowledge of risks involved in the operation and is medically examined periodically. •Contractor should prepare a site Emergency Preparedness and Response Procedure, which should be followed for the subjected project. •Adequate training should be provided to staff about raising awareness about use of Personal Protection Equipment (PPE) and emergency response measures; •Job responsibility and shifting chart should be prepared so that no person shall be over exhausted, which will ultimately lead to the accident or injuries; •Safety sign should also be marked at appropriate places. •It shall also be ensured that good housekeeping at the construction site is maintained to avoid slips and falls. •Excessive waste debris and liquid spills will be cleaned up regularly, while electrical cords and ropes will be placed along identified corridors marked for the attention of everyone at the site. •Use of personal fall arrest system, such as full body harnesses as well as fall rescue procedures to deal with workers whose fall has been successfully arrested shall also be carried out. •Dropping/lowering dismantled objects or tool will be restricted and undertaken only under strict supervision if required. PPEs such as safety glasses with side shields, face shields, hard hats and safety shoes shall be mandatory at a construction site. Earplugs shall be provided for workers placed in high noise areas.	Minor	Decommissioning Contractor HSE Manager	NCEC Supervisor	Internal audit, meeting with technical and other staff and record (Monthly Monitoring)	Report from designated HSE personnel

10. CONCLUSION

The environmental and social impact assessment of the proposed wind Power plant of Starah has been conducted in accordance with the administrative framework, identified herein, including national legislative requirement, the World Bank Policies, IFC's Performance Standards and World Bank's Environmental Health and Safety (EHS) Guidelines and the national Saudi environmental guidelines.

The ESIA study has been carried out based on the site visit, baseline environmental and social condition survey, stakeholder consultation, analysis of the possible project intervention and finally potential environmental impact associated with all aspects of the proposed project was identified and evaluated. The proposed project will be developed bare land with no human activity observed.

10.1 Environmental and social impacts generated

The key environmental impact due to the project construction observed as an outcome of the ESIA study impacts on land use, drainage pattern change, water quality solid waste generation and disposal, increase traffic and transport and occupational health and safety. The economic opportunities in terms of local employment during construction and operation phase are assessed as positive. During the operation of the proposed project, the key issues related to the environment has been identified from the ESIA study are hazardous waste generation and management, ecological, visual impact and occupational health and safety.

In terms of biodiversity features, construction activities will have minor impacts on terrestrial habitats and flora due to removal of vegetation as well as disturbance and displacement of fauna. Operation phase will likely have no significant impact on the biodiversity, except birds, as wind energy production is classified a green energy alternative.

The ESIA predicts that residual environmental impacts of minor to moderate significance may occur as a result of the Project. The ESIA study has established that potential impacts associated with the Project activities are not detrimental in nature and anticipated to be successfully managed through effective implementation of successful Environmental and social management plan

10.2 The Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) describes mitigation measures for impacts specific to the project activities and also discuss implementation mechanism for recommended mitigation measures along with monitoring plan.

The ESMP also suggest following number of Project specific management plans to be implemented by the Project Contractors.

Implementation of ESMP will help EPC contractor to comply with the national regulatory framework as well as to meet IFC Performance Standard requirements.

The project should take structurally protective measures towards winds, sandstorms as the site is located in a desert area where these climatologic phenomena are common.

10.3 Stakeholders and their roles

During the performance of the project, several coordination activities have been carried out between the Stakeholders and the Designs Consortium with two main objectives:

- To gather information and data required for the project.
- To reach agreements and non-objection statements to our project design from the various stakeholders' involved departments.

The following Stakeholders and their roles have been identified during the process of the project development.

- Shepherders / Camel herders: Project Affected People – Need to be resettled from the site.
- Starah Municipality: Wind Power plant on the territory
- Ministry of Interior: Security restrictions that must be considered
- Ministry of defense: Neighbouring / Security restrictions that must be considered
- Ministry of National Guard: Neighbouring / Security restrictions that must be considered
- National Center for Vegetation Cover: Biodiversity protection / Environmental restrictions
- The National Centre for Wildlife: Biodiversity protection / Environmental restrictions
- General Authority of Civil Aviation: The flight way, if any, in the project area.

Appendix A. Soil Analysis

Sample Location	Sample Soil-1
Lab Sample ID	G-0700322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.23	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1243	n/a
Chloride	EPA 9212	0.01	µg/g	132	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	39.63	n/a
Magnesium	EPA 3050	0.01	µg/g	31.25	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	27.52	n/a
Calcium	EPA 3050	0.01	µg/g	23.63	n/a
Chromium	EPA 3050	0.1	µg/g	3.32	64
Manganese	EPA 3050	0.1	µg/g	1.24	n/a
Iron	EPA 3050	0.01	µg/g	0.22	n/a
Cobalt	EPA 3050	0.1	µg/g	0.96	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2.34	63
Zinc	EPA 3050	0.01	µg/g	5.23	200
Arsenic	EPA 3050	0.01	µg/g	1.32	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	3.19	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.21	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-1
Lab Sample ID	G-0700322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]perylene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012

Sample Location	Sample Soil-1
Lab Sample ID	G-0700322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-2
Lab Sample ID	G-0710322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	8.2	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1342	n/a
Chloride	EPA 9212	0.01	µg/g	96	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	42.16	n/a
Magnesium	EPA 3050	0.01	µg/g	33.6	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	29.6	n/a
Calcium	EPA 3050	0.01	µg/g	21.82	n/a
Chromium	EPA 3050	0.1	µg/g	5.27	64
Manganese	EPA 3050	0.1	µg/g	1.82	n/a
Iron	EPA 3050	0.01	µg/g	0.35	n/a
Cobalt	EPA 3050	0.1	µg/g	0.79	20
Nickel	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	4.67	63
Zinc	EPA 3050	0.01	µg/g	5.96	200
Arsenic	EPA 3050	0.01	µg/g	2.81	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	3.67	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12

Sample Location	Sample Soil-2
Lab Sample ID	G-0710322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	2.36	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078

Sample Location	Sample Soil-2
Lab Sample ID	G-0710322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-3
Lab Sample ID	G-0720322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.68	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1192	n/a
Chloride	EPA 9212	0.01	µg/g	91	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	38.73	n/a
Magnesium	EPA 3050	0.01	µg/g	30.91	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	32.7	n/a
Calcium	EPA 3050	0.01	µg/g	23.67	n/a
Chromium	EPA 3050	0.1	µg/g	4.29	64
Manganese	EPA 3050	0.1	µg/g	1.44	n/a
Iron	EPA 3050	0.01	µg/g	0.26	n/a
Cobalt	EPA 3050	0.1	µg/g	0.53	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	3.89	63
Zinc	EPA 3050	0.01	µg/g	4.79	200
Arsenic	EPA 3050	0.01	µg/g	2.36	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	2.96	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12

Sample Location	Sample Soil-3
Lab Sample ID	G-0720322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.89	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a

Sample Location	Sample Soil-3
Lab Sample ID	G-0720322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-4
Lab Sample ID	G-0730322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.03	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1288	n/a
Chloride	EPA 9212	0.01	µg/g	107	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	36.15	n/a
Magnesium	EPA 3050	0.01	µg/g	26.95	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	30.73	n/a
Calcium	EPA 3050	0.01	µg/g	20.25	n/a
Chromium	EPA 3050	0.1	µg/g	2.69	64
Manganese	EPA 3050	0.1	µg/g	1.17	n/a
Iron	EPA 3050	0.01	µg/g	0.21	n/a
Cobalt	EPA 3050	0.1	µg/g	0.38	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	5.28	63
Zinc	EPA 3050	0.01	µg/g	6.37	200
Arsenic	EPA 3050	0.01	µg/g	1.92	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	3.85	750

Sample Location	Sample Soil-4
Lab Sample ID	G-0730322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	2.06	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a

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Sample Location	Sample Soil-4
Lab Sample ID	G-0730322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEx)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-5
Lab Sample ID	G-0740322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	8.03	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1391	n/a
Chloride	EPA 9212	0.01	μg/g	104	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	39.66	n/a
Magnesium	EPA 3050	0.01	μg/g	29.27	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	33.62	n/a
Calcium	EPA 3050	0.01	μg/g	24.26	n/a
Chromium	EPA 3050	0.1	μg/g	3.84	64
Manganese	EPA 3050	0.1	μg/g	3.02	n/a
Iron	EPA 3050	0.01	μg/g	0.28	n/a
Cobalt	EPA 3050	0.1	μg/g	0.47	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	3.79	63
Zinc	EPA 3050	0.01	μg/g	6.03	200
Arsenic	EPA 3050	0.01	μg/g	2.84	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	3.11	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	2.86	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800

Sample Location	Sample Soil-5
Lab Sample ID	G-0740322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-6
Lab Sample ID	G-0750322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	8.14	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1416	n/a
Chloride	EPA 9212	0.01	μg/g	135	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	35.74	n/a
Magnesium	EPA 3050	0.01	μg/g	31.82	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	35.71	n/a
Calcium	EPA 3050	0.01	μg/g	26.32	n/a
Chromium	EPA 3050	0.1	μg/g	3.97	64
Manganese	EPA 3050	0.1	μg/g	3.73	n/a
Iron	EPA 3050	0.01	μg/g	0.42	n/a
Cobalt	EPA 3050	0.1	μg/g	0.25	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	3.19	63
Zinc	EPA 3050	0.01	μg/g	5.49	200
Arsenic	EPA 3050	0.01	μg/g	1.84	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	2.38	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.59	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-6
Lab Sample ID	G-0750322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-7
Lab Sample ID	G-0760322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.72	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1256	n/a
Chloride	EPA 9212	0.01	μg/g	115	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	31.26	n/a
Magnesium	EPA 3050	0.01	μg/g	27.83	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	30.52	n/a
Calcium	EPA 3050	0.01	μg/g	27.6	n/a
Chromium	EPA 3050	0.1	μg/g	2.26	64
Manganese	EPA 3050	0.1	μg/g	1.89	n/a
Iron	EPA 3050	0.01	μg/g	0.21	n/a
Cobalt	EPA 3050	0.1	μg/g	0.29	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	2.06	63
Zinc	EPA 3050	0.01	μg/g	3.79	200
Arsenic	EPA 3050	0.01	μg/g	1.27	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	1.74	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.59	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-7
Lab Sample ID	G-0760322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-8
Lab Sample ID	G-0770322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.15	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1096	n/a
Chloride	EPA 9212	0.01	μg/g	97	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	27.31	n/a
Magnesium	EPA 3050	0.01	μg/g	25.69	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	27.15	n/a
Calcium	EPA 3050	0.01	μg/g	23.69	n/a
Chromium	EPA 3050	0.1	μg/g	1.47	64
Manganese	EPA 3050	0.1	μg/g	1.26	n/a
Iron	EPA 3050	0.01	μg/g	0.26	n/a
Cobalt	EPA 3050	0.1	μg/g	0.21	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	2.37	63
Zinc	EPA 3050	0.01	μg/g	2.18	200
Arsenic	EPA 3050	0.01	μg/g	1.13	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	1.41	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.36	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300

Sample Location	Sample Soil-8
Lab Sample ID	G-0770322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-9
Lab Sample ID	G-0780322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.89	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1168	n/a
Chloride	EPA 9212	0.01	μg/g	102	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	29.38	n/a
Magnesium	EPA 3050	0.01	μg/g	28.42	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	29.65	n/a
Calcium	EPA 3050	0.01	μg/g	27.23	n/a
Chromium	EPA 3050	0.1	μg/g	2.83	64
Manganese	EPA 3050	0.1	μg/g	3.17	n/a
Iron	EPA 3050	0.01	μg/g	0.39	n/a
Cobalt	EPA 3050	0.1	μg/g	0.26	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	2.79	63
Zinc	EPA 3050	0.01	μg/g	2.58	200
Arsenic	EPA 3050	0.01	μg/g	1.71	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	2.09	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	3.16	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-9
Lab Sample ID	G-0780322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-10
Lab Sample ID	G-0790322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	..... ...	8.26	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1372	n/a
Chloride	EPA 9212	0.01	μg/g	129	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	32.67	n/a
Magnesium	EPA 3050	0.01	μg/g	30.72	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	33.94	n/a
Calcium	EPA 3050	0.01	μg/g	31.64	n/a
Chromium	EPA 3050	0.1	μg/g	3.87	64
Manganese	EPA 3050	0.1	μg/g	3.53	n/a
Iron	EPA 3050	0.01	μg/g	0.39	n/a
Cobalt	EPA 3050	0.1	μg/g	0.31	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	3.67	63
Zinc	EPA 3050	0.01	μg/g	3.92	200
Arsenic	EPA 3050	0.01	μg/g	2.49	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	2.63	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	4.27	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300

Sample Location	Sample Soil-10
Lab Sample ID	G-0790322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEx)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-11
Lab Sample ID	G-0800322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.66	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1157	n/a
Chloride	EPA 9212	0.01	µg/g	110	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	31.67	n/a
Magnesium	EPA 3050	0.01	µg/g	28.64	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	27.39	n/a
Calcium	EPA 3050	0.01	µg/g	29.81	n/a
Chromium	EPA 3050	0.1	µg/g	3.52	64
Manganese	EPA 3050	0.1	µg/g	3.11	n/a
Iron	EPA 3050	0.01	µg/g	0.22	n/a
Cobalt	EPA 3050	0.1	µg/g	0.25	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2.77	63
Zinc	EPA 3050	0.01	µg/g	2.13	200
Arsenic	EPA 3050	0.01	µg/g	1.96	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	1.71	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	2.38	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-11
Lab Sample ID	G-0800322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-12
Lab Sample ID	G-0810322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.23	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1067	n/a
Chloride	EPA 9212	0.01	µg/g	93	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	28.51	n/a
Magnesium	EPA 3050	0.01	µg/g	25.23	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	24.39	n/a
Calcium	EPA 3050	0.01	µg/g	27.16	n/a
Chromium	EPA 3050	0.1	µg/g	2.55	64
Manganese	EPA 3050	0.1	µg/g	2.89	n/a
Iron	EPA 3050	0.01	µg/g	0.22	n/a
Cobalt	EPA 3050	0.1	µg/g	0.21	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2.34	63
Zinc	EPA 3050	0.01	µg/g	1.84	200
Arsenic	EPA 3050	0.01	µg/g	1.73	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	1.57	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	3.06	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-12
Lab Sample ID	G-0810322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-13
Lab Sample ID	G-0820322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	8.11	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1362	n/a
Chloride	EPA 9212	0.01	μg/g	105	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	29.67	n/a
Magnesium	EPA 3050	0.01	μg/g	28.23	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	28.97	n/a
Calcium	EPA 3050	0.01	μg/g	30.17	n/a
Chromium	EPA 3050	0.1	μg/g	3.36	64
Manganese	EPA 3050	0.1	μg/g	3.89	n/a
Iron	EPA 3050	0.01	μg/g	0.41	n/a
Cobalt	EPA 3050	0.1	μg/g	0.37	20
Nickel	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	3.85	63
Zinc	EPA 3050	0.01	μg/g	2.94	200
Arsenic	EPA 3050	0.01	μg/g	2.36	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	2.27	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	3.49	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-13
Lab Sample ID	G-0820322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-14
Lab Sample ID	G-0830322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	8.1	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1416	n/a
Chloride	EPA 9212	0.01	μg/g	130	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	31.76	n/a
Magnesium	EPA 3050	0.01	μg/g	29.85	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	30.49	n/a
Calcium	EPA 3050	0.01	μg/g	33.61	n/a
Chromium	EPA 3050	0.1	μg/g	3.82	64
Manganese	EPA 3050	0.1	μg/g	4.36	n/a
Iron	EPA 3050	0.01	μg/g	0.37	n/a
Cobalt	EPA 3050	0.1	μg/g	0.31	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	4.27	63
Zinc	EPA 3050	0.01	μg/g	3.69	200
Arsenic	EPA 3050	0.01	μg/g	4.18	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	3.89	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	4.16	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-14
Lab Sample ID	G-0830322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-15
Lab Sample ID	G-0840322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.25	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1364	n/a
Chloride	EPA 9212	0.01	μg/g	156	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	45.6	n/a
Magnesium	EPA 3050	0.01	μg/g	34.5	n/a
Aluminum	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	39.85	n/a
Calcium	EPA 3050	0.01	μg/g	41.5	n/a
Chromium	EPA 3050	0.1	μg/g	5.32	64
Manganese	EPA 3050	0.1	μg/g	5.21	n/a
Iron	EPA 3050	0.01	μg/g	0.44	n/a
Cobalt	EPA 3050	0.1	μg/g	0.36	20
Nickel	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	3.52	63
Zinc	EPA 3050	0.01	μg/g	7.69	200
Arsenic	EPA 3050	0.01	μg/g	2.25	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	2.56	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	2.14	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-15
Lab Sample ID	G-0840322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-16
Lab Sample ID	G-0850322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.34	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1454	n/a
Chloride	EPA 9212	0.01	µg/g	147	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	41.2	n/a
Magnesium	EPA 3050	0.01	µg/g	30.6	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	38.5	n/a
Calcium	EPA 3050	0.01	µg/g	48.5	n/a
Chromium	EPA 3050	0.1	µg/g	4.69	64
Manganese	EPA 3050	0.1	µg/g	3.24	n/a
Iron	EPA 3050	0.01	µg/g	0.64	n/a
Cobalt	EPA 3050	0.1	µg/g	0.49	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	5.37	63
Zinc	EPA 3050	0.01	µg/g	6.48	200
Arsenic	EPA 3050	0.01	µg/g	1.85	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	3.52	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	2.14	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons (TPH)	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800

Sample Location	Sample Soil-16
Lab Sample ID	G-0850322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting	Unit	Result	NCEC Limit
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-17
Lab Sample ID	G-0860322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.41	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1325	n/a
Chloride	EPA 9212	0.01	μg/g	130	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	35.6	n/a
Magnesium	EPA 3050	0.01	μg/g	27.9	n/a
Aluminum	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	33.2	n/a
Calcium	EPA 3050	0.01	μg/g	45.2	n/a
Chromium	EPA 3050	0.1	μg/g	6.5	64
Manganese	EPA 3050	0.1	μg/g	6.6	n/a
Iron	EPA 3050	0.01	μg/g	0.6	n/a
Cobalt	EPA 3050	0.1	μg/g	0.47	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	7.89	63
Zinc	EPA 3050	0.01	μg/g	5.48	200
Arsenic	EPA 3050	0.01	μg/g	1.45	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	2.45	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	2.74	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-17
Lab Sample ID	G-0860322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-18
Lab Sample ID	G-0870322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.14	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1247	n/a
Chloride	EPA 9212	0.01	µg/g	122	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	29.8	n/a
Magnesium	EPA 3050	0.01	µg/g	23.9	n/a
Aluminum	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	30.6	n/a
Calcium	EPA 3050	0.01	µg/g	41.5	n/a
Chromium	EPA 3050	0.1	µg/g	4.3	64
Manganese	EPA 3050	0.1	µg/g	5.5	n/a
Iron	EPA 3050	0.01	µg/g	0.71	n/a
Cobalt	EPA 3050	0.1	µg/g	0.69	20
Nickel	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	9.3	63
Zinc	EPA 3050	0.01	µg/g	10.6	200
Arsenic	EPA 3050	0.01	µg/g	1.12	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	1.45	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.95	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-18
Lab Sample ID	G-0870322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-19
Lab Sample ID	G-0880322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.54	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1450	n/a
Chloride	EPA 9212	0.01	μg/g	137	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	36.9	n/a
Magnesium	EPA 3050	0.01	μg/g	27.8	n/a
Aluminum	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	36.5	n/a
Calcium	EPA 3050	0.01	μg/g	49.9	n/a
Chromium	EPA 3050	0.1	μg/g	2.9	64
Manganese	EPA 3050	0.1	μg/g	0.67	n/a
Iron	EPA 3050	0.01	μg/g	0.75	n/a
Cobalt	EPA 3050	0.1	μg/g	0.81	20
Nickel	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	7.4	63
Zinc	EPA 3050	0.01	μg/g	12.6	200
Arsenic	EPA 3050	0.01	μg/g	2.16	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	3.69	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.54	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-19
Lab Sample ID	G-0880322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-20
Lab Sample ID	G-0890322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.62	8.5

Sample Location	Sample Soil-20
Lab Sample ID	G-0890322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting	Unit	Result	NCEC Limit
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1596	n/a
Chloride	EPA 9212	0.01	μg/g	211	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	50.6	n/a
Magnesium	EPA 3050	0.01	μg/g	48.9	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	47.9	n/a
Calcium	EPA 3050	0.01	μg/g	61.9	n/a
Chromium	EPA 3050	0.1	μg/g	6.5	64
Manganese	EPA 3050	0.1	μg/g	0.84	n/a
Iron	EPA 3050	0.01	μg/g	0.95	n/a
Cobalt	EPA 3050	0.1	μg/g	0.58	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	8.6	63
Zinc	EPA 3050	0.01	μg/g	9.6	200
Arsenic	EPA 3050	0.01	μg/g	1.96	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	4.56	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.26	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-20
Lab Sample ID	G-0890322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting	Unit	Result	NCEC Limit
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-21
Lab Sample ID	G-0900322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.28	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1453	n/a
Chloride	EPA 9212	0.01	µg/g	185	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	46.2	n/a
Magnesium	EPA 3050	0.01	µg/g	41.2	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	39.5	n/a
Calcium	EPA 3050	0.01	µg/g	53.6	n/a
Chromium	EPA 3050	0.1	µg/g	4.69	64
Manganese	EPA 3050	0.1	µg/g	0.74	n/a
Iron	EPA 3050	0.01	µg/g	0.49	n/a
Cobalt	EPA 3050	0.1	µg/g	0.58	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	4.5	63
Zinc	EPA 3050	0.01	µg/g	7.45	200
Arsenic	EPA 3050	0.01	µg/g	1.25	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	3.25	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.62	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-21
Lab Sample ID	G-0900322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-22
Lab Sample ID	G-0910322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.75	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1545	n/a
Chloride	EPA 9212	0.01	µg/g	206	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	53.6	n/a
Magnesium	EPA 3050	0.01	µg/g	49.8	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	47.9	n/a
Calcium	EPA 3050	0.01	µg/g	54.9	n/a
Chromium	EPA 3050	0.1	µg/g	4.62	64
Manganese	EPA 3050	0.1	µg/g	0.96	n/a
Iron	EPA 3050	0.01	µg/g	0.49	n/a
Cobalt	EPA 3050	0.1	µg/g	0.69	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2.5	63
Zinc	EPA 3050	0.01	µg/g	9.6	200
Arsenic	EPA 3050	0.01	µg/g	1.14	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	2.47	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	2.25	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300

Sample Location	Sample Soil-22
Lab Sample ID	G-0910322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-23
Lab Sample ID	G-0920322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.73	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1215	n/a
Chloride	EPA 9212	0.01	µg/g	162	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	41	n/a
Magnesium	EPA 3050	0.01	µg/g	35.6	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	35.6	n/a
Calcium	EPA 3050	0.01	µg/g	53.6	n/a
Chromium	EPA 3050	0.1	µg/g	3.6	64
Manganese	EPA 3050	0.1	µg/g	1.56	n/a
Iron	EPA 3050	0.01	µg/g	1.22	n/a
Cobalt	EPA 3050	0.1	µg/g	3.2	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	6.6	63
Zinc	EPA 3050	0.01	µg/g	15.6	200
Arsenic	EPA 3050	0.01	µg/g	2.2	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	2.1	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.52	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-23
Lab Sample ID	G-0920322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-24
Lab Sample ID	G-0930322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.53	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1362	n/a
Chloride	EPA 9212	0.01	μg/g	179	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	45.6	n/a
Magnesium	EPA 3050	0.01	μg/g	39.9	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	41.6	n/a
Calcium	EPA 3050	0.01	μg/g	69.5	n/a
Chromium	EPA 3050	0.1	μg/g	4.4	64
Manganese	EPA 3050	0.1	μg/g	2.12	n/a
Iron	EPA 3050	0.01	μg/g	1.69	n/a
Cobalt	EPA 3050	0.1	μg/g	2.1	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	4.4	63
Zinc	EPA 3050	0.01	μg/g	11.2	200
Arsenic	EPA 3050	0.01	μg/g	1.96	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	1.45	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.45	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-24
Lab Sample ID	G-0930322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-25
Lab Sample ID	G-0940322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.95	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1784	n/a
Chloride	EPA 9212	0.01	μg/g	259	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	64.5	n/a
Magnesium	EPA 3050	0.01	μg/g	49.8	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	58.3	n/a
Calcium	EPA 3050	0.01	μg/g	74.6	n/a
Chromium	EPA 3050	0.1	μg/g	6.5	64
Manganese	EPA 3050	0.1	μg/g	2.41	n/a
Iron	EPA 3050	0.01	μg/g	1.41	n/a
Cobalt	EPA 3050	0.1	μg/g	2.1	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	3.2	63
Zinc	EPA 3050	0.01	μg/g	17.6	200
Arsenic	EPA 3050	0.01	μg/g	2.2	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	1.21	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.21	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-25
Lab Sample ID	G-0940322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-26
Lab Sample ID	G-0950322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.45	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1612	n/a
Chloride	EPA 9212	0.01	µg/g	216	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	59.4	n/a
Magnesium	EPA 3050	0.01	µg/g	45	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	52	n/a
Calcium	EPA 3050	0.01	µg/g	68.9	n/a
Chromium	EPA 3050	0.1	µg/g	6.5	64
Manganese	EPA 3050	0.1	µg/g	2.02	n/a
Iron	EPA 3050	0.01	µg/g	1.32	n/a
Cobalt	EPA 3050	0.1	µg/g	3.6	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2.9	63
Zinc	EPA 3050	0.01	µg/g	15.9	200
Arsenic	EPA 3050	0.01	µg/g	1.54	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	1.41	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.45	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-26
Lab Sample ID	G-0950322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEx)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-27
Lab Sample ID	G-0960322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.95	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1417	n/a
Chloride	EPA 9212	0.01	µg/g	185	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	55.9	n/a
Magnesium	EPA 3050	0.01	µg/g	41	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	48	n/a
Calcium	EPA 3050	0.01	µg/g	61.2	n/a
Chromium	EPA 3050	0.1	µg/g	3.6	64
Manganese	EPA 3050	0.1	µg/g	0.98	n/a
Iron	EPA 3050	0.01	µg/g	0.74	n/a
Cobalt	EPA 3050	0.1	µg/g	2.1	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	1.22	63
Zinc	EPA 3050	0.01	µg/g	18.9	200
Arsenic	EPA 3050	0.01	µg/g	2.11	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	1.12	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.08	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-27
Lab Sample ID	G-0960322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-28
Lab Sample ID	G-0970322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.34	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1325	n/a
Chloride	EPA 9212	0.01	µg/g	149	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	48.9	n/a
Magnesium	EPA 3050	0.01	µg/g	36.6	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	42.2	n/a
Calcium	EPA 3050	0.01	µg/g	55.9	n/a
Chromium	EPA 3050	0.1	µg/g	4.5	64
Manganese	EPA 3050	0.1	µg/g	1.63	n/a
Iron	EPA 3050	0.01	µg/g	0.93	n/a
Cobalt	EPA 3050	0.1	µg/g	1.5	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2	63
Zinc	EPA 3050	0.01	µg/g	14.3	200
Arsenic	EPA 3050	0.01	µg/g	2.2	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	1.07	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.35	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-28
Lab Sample ID	G-0970322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-29
Lab Sample ID	G-0980322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	8.12	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1695	n/a
Chloride	EPA 9212	0.01	µg/g	188	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	56.3	n/a
Magnesium	EPA 3050	0.01	µg/g	49	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	53.6	n/a
Calcium	EPA 3050	0.01	µg/g	65.8	n/a
Chromium	EPA 3050	0.1	µg/g	4.5	64
Manganese	EPA 3050	0.1	µg/g	2.11	n/a
Iron	EPA 3050	0.01	µg/g	1.56	n/a
Cobalt	EPA 3050	0.1	µg/g	1.54	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	2.6	63
Zinc	EPA 3050	0.01	µg/g	17.5	200
Arsenic	EPA 3050	0.01	µg/g	2.2	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	0.95	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.22	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-29
Lab Sample ID	G-0980322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-30
Lab Sample ID	G-0990322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.86	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1548	n/a
Chloride	EPA 9212	0.01	µg/g	174	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	59.8	n/a
Magnesium	EPA 3050	0.01	µg/g	53.6	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	58.9	n/a
Calcium	EPA 3050	0.01	µg/g	68.9	n/a
Chromium	EPA 3050	0.1	µg/g	3.6	64
Manganese	EPA 3050	0.1	µg/g	1.58	n/a
Iron	EPA 3050	0.01	µg/g	2.3	n/a
Cobalt	EPA 3050	0.1	µg/g	1.21	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	1.96	63
Zinc	EPA 3050	0.01	µg/g	19.5	200
Arsenic	EPA 3050	0.01	µg/g	1.14	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	<0.1	3.8
Barium	EPA 3050	0.1	µg/g	0.96	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.27	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-30
Lab Sample ID	G-0990322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-31
Lab Sample ID	G-1000322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	8.21	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1781	n/a
Chloride	EPA 9212	0.01	μg/g	232	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	65.3	n/a
Magnesium	EPA 3050	0.01	μg/g	59.2	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	62.2	n/a
Calcium	EPA 3050	0.01	μg/g	78.6	n/a
Chromium	EPA 3050	0.1	μg/g	2.3	64
Manganese	EPA 3050	0.1	μg/g	2.44	n/a
Iron	EPA 3050	0.01	μg/g	2.1	n/a
Cobalt	EPA 3050	0.1	μg/g	1.21	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	1.49	63
Zinc	EPA 3050	0.01	μg/g	16.5	200
Arsenic	EPA 3050	0.01	μg/g	1.54	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	<0.1	3.8
Barium	EPA 3050	0.1	μg/g	0.76	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.34	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-31
Lab Sample ID	G-1000322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-32
Lab Sample ID	G-1010322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.74	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1596	n/a
Chloride	EPA 9212	0.01	µg/g	202	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	60.2	n/a
Magnesium	EPA 3050	0.01	µg/g	52.9	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	57.6	n/a
Calcium	EPA 3050	0.01	µg/g	67.6	n/a
Chromium	EPA 3050	0.1	µg/g	2.1	64
Manganese	EPA 3050	0.1	µg/g	2.17	n/a
Iron	EPA 3050	0.01	µg/g	1.46	n/a
Cobalt	EPA 3050	0.1	µg/g	1.43	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	1.83	63
Zinc	EPA 3050	0.01	µg/g	12.3	200
Arsenic	EPA 3050	0.01	µg/g	1.85	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	0.22	3.8
Barium	EPA 3050	0.1	µg/g	0.65	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.27	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-32
Lab Sample ID	G-1010322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-33
Lab Sample ID	G-1020322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.35	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1295	n/a
Chloride	EPA 9212	0.01	μg/g	146	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	51.3	n/a
Magnesium	EPA 3050	0.01	μg/g	43.6	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	48.6	n/a
Calcium	EPA 3050	0.01	μg/g	54.6	n/a
Chromium	EPA 3050	0.1	μg/g	2.1	64
Manganese	EPA 3050	0.1	μg/g	1.41	n/a
Iron	EPA 3050	0.01	μg/g	1.63	n/a
Cobalt	EPA 3050	0.1	μg/g	1.89	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	2.6	63
Zinc	EPA 3050	0.01	μg/g	15	200
Arsenic	EPA 3050	0.01	μg/g	1.5	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	0.15	3.8
Barium	EPA 3050	0.1	μg/g	0.6	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.36	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-33
Lab Sample ID	G-1020322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-34
Lab Sample ID	G-1030322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.54	8.5
Electric Conductivity	EPA 2510 B	0.1	µS/cm	1358	n/a
Chloride	EPA 9212	0.01	µg/g	169	n/a
Boron	EPA 3050	0.01	µg/g	<0.01	3.3
Sodium	EPA 3050	0.01	µg/g	57.6	n/a
Magnesium	EPA 3050	0.01	µg/g	49.8	n/a
Aluminium	EPA 3050	0.1	µg/g	<0.1	n/a
Potassium	EPA 3050	0.01	µg/g	58.6	n/a
Calcium	EPA 3050	0.01	µg/g	68.9	n/a
Chromium	EPA 3050	0.1	µg/g	1.4	64
Manganese	EPA 3050	0.1	µg/g	1.76	n/a
Iron	EPA 3050	0.01	µg/g	1.35	n/a
Cobalt	EPA 3050	0.1	µg/g	0.96	20
Nickal	EPA 3050	0.01	µg/g	<0.01	45
Copper	EPA 3050	0.2	µg/g	1.54	63
Zinc	EPA 3050	0.01	µg/g	16.5	200
Arsenic	EPA 3050	0.01	µg/g	1.3	17
Silver	EPA 3050	0.05	µg/g	<0.05	20
Cadmium	EPA 3050	0.1	µg/g	0.14	3.8
Barium	EPA 3050	0.1	µg/g	0.67	750
Mercury	EPA 3050	0.3	µg/g	<0.001	12
Cyanide	EPA 3050	0.01	µg/g	<0.01	0.9
Lead	EPA 3050	0.01	µg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	µg/g	1.25	n/a
Total Organic Carbon	EPA 9060	1	µg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-34
Lab Sample ID	G-1030322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene, ,	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Sample Location	Sample Soil-35
Lab Sample ID	G-1040322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
Hydrogen Value	EPA 9045 D	0.01	.....	7.73	8.5
Electric Conductivity	EPA 2510 B	0.1	μS/cm	1652	n/a
Chloride	EPA 9212	0.01	μg/g	193	n/a
Boron	EPA 3050	0.01	μg/g	<0.01	3.3
Sodium	EPA 3050	0.01	μg/g	63.5	n/a
Magnesium	EPA 3050	0.01	μg/g	59.3	n/a
Aluminium	EPA 3050	0.1	μg/g	<0.1	n/a
Potassium	EPA 3050	0.01	μg/g	67	n/a
Calcium	EPA 3050	0.01	μg/g	73.6	n/a
Chromium	EPA 3050	0.1	μg/g	3.2	64
Manganese	EPA 3050	0.1	μg/g	2.8	n/a
Iron	EPA 3050	0.01	μg/g	1.48	n/a
Cobalt	EPA 3050	0.1	μg/g	1.14	20
Nickal	EPA 3050	0.01	μg/g	<0.01	45
Copper	EPA 3050	0.2	μg/g	2.3	63
Zinc	EPA 3050	0.01	μg/g	12.2	200
Arsenic	EPA 3050	0.01	μg/g	1.9	17
Silver	EPA 3050	0.05	μg/g	<0.05	20
Cadmium	EPA 3050	0.1	μg/g	0.14	3.8
Barium	EPA 3050	0.1	μg/g	0.42	750
Mercury	EPA 3050	0.3	μg/g	<0.001	12
Cyanide	EPA 3050	0.01	μg/g	<0.01	0.9
Lead	EPA 3050	0.01	μg/g	<0.01	70
Total Phosphorus	EPA 365.2	0.01	μg/g	1.29	n/a
Total Organic Carbon	EPA 9060	1	μg/g	<1	n/a
Total Petroleum Hydrocarbons	USEPA 8260B	50	mg/Kg	<50	n/a
C6 – C10 Fraction	USEPA 8260B	50	mg/Kg	<50	210
C10 - C16 Fraction	USEPA 8260B	50	mg/Kg	<50	150
C16 – C34 Fraction	USEPA 8260B	50	mg/Kg	<50	300
C34 – C50 Fraction	USEPA 8260B	50	mg/Kg	<50	2800
C29 - C36 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a

Sample Location	Sample Soil-35
Lab Sample ID	G-1040322
Sampling Date	28-02-2022

Parameter	Methodology	Limit of Reporting (LOR)	Unit	Result	NCEC Limit
C37 - C40 Fraction	USEPA 8260B	50	mg/Kg	<50	n/a
Polyaromatic Hydrocarbons (PAH)	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.039
Pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.04
Chrysene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[a]anthracene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.083
Benzo[k]fluoranthene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	6.2
Benzo[e]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[a]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	0.6
Indeno[1,2,3-cd]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzo[ghi]pyrene	USEPA SW 846 -8270B	0.01	mg/Kg	<0.01	n/a
Benzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.078
Toluene	USEPA 8260B	0.01	mg/Kg	<0.01	0.012
Ethylbenzene	USEPA 8260B	0.01	mg/Kg	<0.01	0.014
Xylene (BTEX)	USEPA 8260B	0.01	mg/Kg	<0.01	1.9

Appendix B. Air Quality Assessment

Hourly data of Air Quality 24 hrs monitoring in Point No 1

Date	Time at 24 Hours	Temp (°C)	Humidity (%)	Wind direction (°)	Wind speed (m/s)	NO (µg/m3)	NO2 (µg/m3)	NOX (µg/m3)	O3 (µg/m3)	H2S (µg/m3)	CO (µg/m3)	SO2 (µg/m3)	PM10 (µg/m3)	PM 2.5 (µg/m3)
21-02-22	7:00:00	14	40	247	21	13.6	44.36	70.25	16.28	0.3628	0.6097	1.0877	192.2	21.7
21-02-22	8:00:00	15	36	266.9	25	15.89	39.85	68.36	24.36	0.3228	0.5925	1.6332	115.2	21.8
21-02-22	9:00:00	16	32	298	27	12.96	49.63	72.96	25.63	0.5489	0.5842	1.5812	106.3	24.6
21-02-22	10:00:00	17	31	315	27	10.458	58.63	66.9	20.4	0.4259	0.5554	1.826	125.4	21
21-02-22	11:00:00	18	29	324	25	12.922	41.58	57.69	26.36	0.3269	0.553	1.5842	81.8	20.7
21-02-22	12:00:00	20	27	288	23	5.963	31.25	40.25	24.12	0.9632	0.5659	2.2287	94.8	22.1
21-02-22	13:00:00	21	26	263	23	8.66	33.96	49.96	19.85	0.7415	0.5896	1.2723	92	23.8
21-02-22	14:00:00	22	25	294	23	10.756	43.96	52.69	26.36	0.3628	0.3514	1.825	145.26	29.36
21-02-22	15:00:00	22	24	305	24	13.69	51.369	63.39	22.36	0.4128	0.3941	1.596	132.269	31.258
21-02-22	16:00:00	21	24	324	23.5	17.956	56.96	69.85	15.96	0.3312	0.4158	1.9647	125.63	28.36
21-02-22	17:00:00	20	24	294	26	18.96	58.99	73.56	18.96	0.30859	0.3994	1.7846	149.36	27.39
21-02-22	18:00:00	19	26	274	26	17.96	63.25	81.25	13.62	0.29418	0.37481	2.145	134.63	27.33
21-02-22	19:00:00	18	28	318	26	22.58	66.41	78.36	17.63	0.4269	0.3941	1.936	128.6	28.52
21-02-22	20:00:00	16	30	284	26	20.69	60.24	83.29	15.62	0.27841	0.3828	2.2214	139.36	28.39

Hourly data of Air Quality 24 hrs monitoring in Point No 1

Date	Time at 24 Hours	Temp (°C)	Humidity (%)	Wind direction (°)	Wind speed (m/s)	NO (µg/m3)	NO2 (µg/m3)	NOX (µg/m3)	O3 (µg/m3)	H2S (µg/m3)	CO (µg/m3)	SO2 (µg/m3)	PM10 (µg/m3)	PM 2.5 (µg/m3)
21-02-22	21:00:00	15	31	278	25	27.63	64.28	75.69	19.36	0.28415	0.4118	1.936	149.23	30.25
21-02-22	22:00:00	14	33	176	24	19.89	51.28	70.26	14.23	0.18719	0.4323	1.7845	165.95	31.256
21-02-22	23:00:00	14	33	165	22	22.96	55.96	67.96	11.52	0.2639	0.3895	2.121	169.39	30.69
21-02-22	24:00:00	13	34	144	13	17.83	58.93	69.33	9.25	0.3691	0.3474	2.0631	176.52	30.256
21-02-22	1:00:00	13	37	149	14	15.96	46.96	59.15	11.63	0.3749	0.3961	2.325	161.29	31.256
21-02-22	2:00:00	12	39	152	13	17.963	43.33	56.66	7.96	0.4158	0.4371	1.836	144.39	29.36
21-02-22	3:00:00	11	41	139	14	23.86	59.69	67.54	8.39	0.4813	0.4621	1.945	132.63	29.45
21-02-22	4:00:00	11	42	148	15	18.63	54.69	66	7.12	0.5299	0.36951	1.769	119.65	27.39
21-02-22	5:00:00	11	41	150	17	15.96	61.33	68.963	5.36	0.4631	0.3396	2.153	96.39	28.36
21-02-22	6:00:00	10	41	146	18	15.25	58.39	69.57	6.96	0.4224	0.3748	1.656	92.33	30.54

Starah 2000 MW Kingdom of Saudi Arabia

ESIA Addendum



July 2025

DOCUMENT INFORMATION

PROJECT NAME	Starah 2000 MW Wind
5Cs PROJECT NUMBER	1305/001/179
DOCUMENT TITLE	Environmental & Social Impact Assessment Addendum
CLIENT	ACWA Power
5Cs PROJECT MANAGER	Lara Bou Ghanem
5Cs DIRECTOR	Ken Wade

DOCUMENT CONTROL

VERSION	VERSION DATE	DESCRIPTION	AUTHOR	REVIEWER	APPROVER
1.0	28/05/2025	ESIA Addendum	AYY	LBG	MKB
2.0	03/06/2025	ESIA Addendum Revision 1	AYY	LBG	MKB
3.0	22/07/2025	ESIA Addendum Revision 2	AYY	LBG	MKB
4.0	24/07/2025	Updates based on LTA Comments	MKB	LBG	MKB



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LIST OF ABBREVIATIONS

ABBREVIATION	MEANING
5 Capitals	5 Capitals Environmental and Management Company
AC	Alternating Current
AoI	Area of Influence
CCPI	Climate Change Performance Index
CCRA	Climate Change Risk Assessment
CEEC	China Energy Engineering Corporation
CIA	Cumulative Impacts Assessment
CO₂-eq	Carbon Dioxide Equivalent
CRI	Climate Risk Index
E&S	Environmental & Social
EPC	Engineering, Procurement, and Construction
EPFI	Equator Principles Financial Institutions
EPs	Equator Principles
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management Systems
ESMP	Environmental and Social Management Plan
GBVH	Gender Based Violence and Harassment
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GRM	Grievance Redress Mechanism
HR	Human Resource
HRGPs	Guiding Principles on Business and Human Rights
HSE	Health, Safety, and Environment
IFC	International Finance Corporation
ILO	International Labour Organization
IRENA	International Renewable Energy Agency
IWGIA	International Work Group for Indigenous Affairs
km	Kilometre
KSA	Kingdom of Saudi Arabia
KWh	Kilowatt Hours
LTA	Lender's Technical Advisor
m	Metre
MEWA	Ministry of Environment, Water and Agriculture
MoL	Ministry of Labour
MoE	Ministry of Energy
Mt	Mega tonnes
MW	Megawatt

NCEC	National Centre for Environmental Compliance
NOMAC	National Operations & Maintenance Company
NREP	National Renewable Energy Program
NTP	Notice to Proceed
O&M	Operations and Maintenance
ODS	Ozone Depleting Substances
OHS	Occupational Health and Safety
OHTL	Overhead Transmission Line
PCOD	Project Commercial Operation Date
PDA	Project Development Agreement
PPA	Power Purchase Agreement
PIF	Public Investment Fund
PPE	Personal Protective Equipment
PS	Performance Standard
REPDO	Renewable Energy Project Development Office
RFP	Request for Proposals
SEA	Sexual Exploitation and Abuse
SEC	Saudi Electricity Company
SEP	Stakeholder Engagement Plan
SGI	Saudi Green Initiative
SH	Sexual Harassment
SPPC	Saudi Power Procurement Company
SPV	Special Purpose Vehicle
SSP	Shared Socioeconomic Pathways
SUA	Site Utilisation Agreement
TCFD	Task Force on Climate-related Financial Disclosures
UAE	United Arab Emirates
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VEC	Vulnerable Environmental Components
VOC	Volatile Organic Compound
WHO	World Health Organization
WTG	Wind Turbine Generator

1 INTRODUCTION

1.1 The Project

ACWA Power is developing the 2,000 MW Starah Wind Power Plant ("the Project") to be located in Starah, within the Al Aflaj Governorate of the Riyadh Region, Kingdom of Saudi Arabia. The Project will operate under a 25-year Power Purchase Agreement (PPA) with the Saudi Power Procurement Company (SPPC).

The Project forms part of the Kingdom's strategic objective to diversify its domestic energy mix under the National Renewable Energy Program (NREP), part of Vision 2030. The NREP aims to increase the share of renewable energy in the national power supply, balance the mix of local energy sources, and contribute to the Kingdom's commitments to reducing greenhouse gas emissions.

1.2 Existing Environmental & Social Impact Assessment

The Ministry of Energy (MoE) appointed TYPASA to provide technical assistance for the preliminary studies of the Project. TYPASA, in turn, commissioned Ali Harbi Environmental Consulting Office as a sub-contractor to carry out the Environmental and Social Impact Assessment (ESIA) for the "Wind Power Project in Starah Governorate". The ESIA was completed in March 2022, and the Project received approval and permitting from the national regulator, the National Centre for Environmental Compliance (NCEC), in July 2022.

In January 2025, the ESIA was reviewed as part of a Gap Analysis undertaken by Mercados-Aries International, the Lenders' Technical Advisor (LTA) acting on behalf of the lender group. The Gap Analysis was intended to support ACWA Power (the Client) in identifying areas of non-alignment with the environmental and social requirements of the Lenders, specifically those set out in the Equator Principles and the IFC Performance Standards. These standards must be met to secure financing from Equator Principles Financial Institutions (EPFIs), including Natixis, Standard Chartered, Mizuho, and Société Générale.

To address the gaps identified in the ESIA, ACWA Power has engaged 5 Capitals Environmental and Management Consultancy (5 Capitals) to prepare an ESIA Addendum.

1.3 Gaps Identified in the Gap Analysis Report

This report is prepared as an Addendum to the existing ESIA and is intended to close out the identified gaps by Mercados-Aries International. These gaps include:

-
- Updated details of Associated Facilities;
 - Identifying the Indirect Area of Influence;
 - Update on Analysis of Project Alternatives;
 - Update of Stakeholder Engagement included into the ESIA;
 - Social Impacts, including Land Use and Ecosystem Services;
 - Human Rights Impacts Assessment which includes community and occupational health and safety;
 - Climate Change Impact Assessment;
 - Cumulative Impact Assessment; and
 - Update to the Environmental and Social Management Plan (ESMP).

To ensure consistency with the original assessment, the impact assessment chapters of this Addendum follow the same methodology used in the original ESIA. The Environmental and Social Management Plan (ESMP) covers only the thematic areas addressed in this Addendum.

2 PROJECT OVERVIEW

Addendum Rationale: Further to the Project Description chapter in the ESIA, this section has been included to address the gaps identified by the LTA. Hence focus herein is in regard to an overview of the Associated Facilities and more details regarding the selected Project Alternatives. It is not intended to repeat the project from the ESIA. The information below has been provided for the purpose of context with regard to this ESIA Addendum.

2.1 Key Project Parties

The Starah 2000 MW Wind Project ("the Project") will operate under a 25-year Power Procurement Agreement (PPA) with the Saudi Power Procurement Company (SPPC). The Special Purpose Vehicle (SPV) Project Company established by ACWA Power to own the Project is the 'Starah First Renewable Energy Company' with the Commercial Registration No. 1009192962. The Project Company has the overall responsibility for developing and owning the Project.

The Project Company has entered into an EPC Contract with China Energy Engineering Corporation (CEEC) who will be contractually responsible for the construction of the Project. The Wind Turbine Generator (WTG) supplier is Goldwind and the Project will use Goldwind model: GWH204-10 MW (boosting to 10.5 MW).

The First National Operations & Maintenance Company (NOMAC), a wholly owned subsidiary of ACWA Power will be responsible for the Operations and Maintenance (O&M) of the Project.

2.2 Associated Facilities

SEC SUB-STATION

The Project will be connected to a 380 kV SEC substation and OHTL to provide connection to the grid. The development and operation of this substation is not within the scope of the Project and is therefore considered as Associated Facilities.

2.3 Temporary Construction Facilities

Although the exact locations of ancillary facilities such as access roads, campsites, and temporary construction areas were not finalized at the time of the ESIA, these components have been assessed as part of the ESIA Addendum.

Since they will be situated within the overall Project boundary, the environmental and social characteristics of these areas are expected to be consistent with those assessed for the wind turbines. As such, the same potential impacts and corresponding mitigation measures identified in the ESIA for the Wind Farm will also apply to these facilities for construction and operational phases.

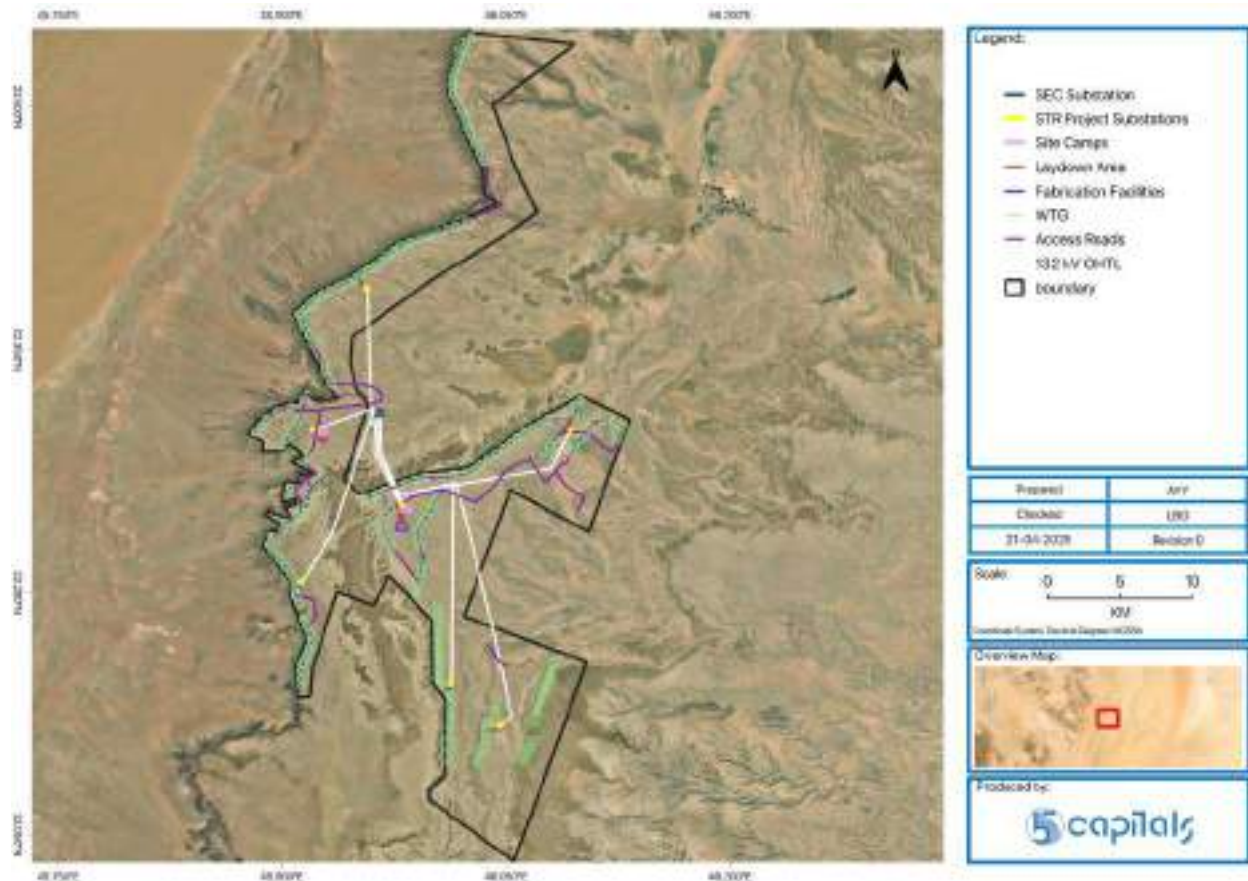


Figure 2-1 Project Components

2.4 Project Alternatives

The selection of the project site, including all preliminary studies and feasibility assessments, was conducted by the Saudi Power Procurement Company (SPPC) prior to the tendering process. As such, ACWA Power has had no involvement in the site selection phase and does not have access to additional information or documentation related to the comparative analysis of alternative sites or technologies that may have been considered by SPPC.

The type of technology to be used, including specifications for turbine models and performance criteria, is determined by the offtaker and detailed in the Request for Proposals (RFP). ACWA Power is required to comply strictly with these requirements as part of the bidding

and project development process and does not have the flexibility to propose alternative technologies outside those outlined in the RFP.

ACWA Power has undertaken site-specific optimization for the siting of the WTGs within the project boundaries to the greatest extent possible. The layout of the WTGs has been optimized based on criteria such as energy yield, turbine efficiency, and operational viability, while also taking into account flood risks and proximity to local communities to minimize potential environmental and social impacts.

A qualitative discussion of the no-project alternative was included in the ESIA. While this focused primarily on the loss of socio-economic benefits, it mentions the predicted negative impacts of the proposed activities (e.g. vegetation clearance, disturbance of habitat, noise and dust generation, etc). In addition, the ESIA acknowledged that the Project Site has low ecological sensitivity, and field surveys recorded limited avifauna activity. The closest Key Biodiversity Area (Hawtat Bani Tamim) is located approximately 90 km from the site and does not meet global KBA criteria. The ESIA therefore concluded that potential environmental advantages under the no-project scenario would be marginal, and that the Project would not significantly impact biodiversity or land-use patterns. In addition, the Project is aligned with the NREP as part of Vision 2030 and is therefore part of the national strategy. Hence, no-project would still require development of another wind farm to reach this strategy in other areas of KSA.

Given the above, and within the data available to ACWA Power, the ESIA provides the most robust alternative analysis feasible under current constraints.

2.5 Indirect Area of Influence

The gap analysis report prepared by Mercados – Aries International identified that the Area of influence (AOI) for indirect/secondary impacts were not specified in the ESIA prepared by TYP SA. Hence, this section aims to outline the AOI for reasonably foreseeable indirect/secondary impacts.

The original ESIA provides an outline of the Project Area of Influence.

‘According to the IFC Performance Standard 1 “where the project involves specifically identified physical elements, aspects, and facilities that are likely to generate impacts, environmental and social risks and impacts will be identified in the context of the project’s area of influence (Aoi)”, which is defined as to encompass the following (IFC, 2012):

- The area likely to be affected by: (i) the project and the client’s activities and facilities that are directly owned, operated or managed (including by contractors) and that

are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent.

- Associated facilities, which are facilities 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.
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly affected by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

The Project AOI consists of the environmental and social aspects within the Project Site, if they exist and receptors within the 500m corridor along the project access roads and Electrical Transfer lines that will potentially be affected by the Project activities and operations and cumulative impacts of nearby other existing plants/facilities.'

The following table identifies the Area of Indirect Influence as requested by the Mercados – Aries International in the ESIA review. Area of Indirect Influence are addressed conceptually but not explicitly mentioned with the exact phrasing in IFC PS1 and the related Guidance Notes. Hence, for the purpose of this ESIA Addendum, we have considered indirect impacts to relate to Project activities not specific to the construction or operations of the Project, such as those that occur due to supply chain and value chains, typically occurring away from the Project site, as outlined in the table below.

Table 2-1 Indirect Area of Influence

THEMATIC AREA	INDIRECT AOI
Air Quality	Transportation of Construction Materials The Area of Indirect Influence is considered to be 200 m from the access road corridor that would be used to transport materials to the site. As a reference, the UK's Design Manual for Roads and Bridges (DMRB) chapter 11 guidance screens air quality impacts from road and highway projects at 200 m. Beyond this distance, emissions from road vehicles are typically indistinguishable from background ambient air quality concentrations.
Noise	Transportation of Construction Materials The Area of Indirect Influence is considered to be approximately 500 m from access roads to the site, which is a reasonable distance for noise propagation from vehicles. The distance is likely to be less than this due to attenuation from intervening structures and topographical features, but may also extend further under certain circumstances, such as calm conditions.
Waste Management	Waste Transportation and Management

THEMATIC AREA	INDIRECT AOI
	Transportation, processing, and disposal of waste materials could pose a threat to the environment and downstream ecosystems, if handled by unlicensed contractors/facilities or those with inadequate pollution controls. This may occur during both the construction and operational phases and will be of more concern related to hazardous waste streams. The AOI for such impacts cannot be specifically defined, but may occur in areas local to waste management facilities and could for example occur to soil and groundwater quality.
Socioeconomics	Transportation of Construction Materials Transportation of construction materials can damage existing roads, worsening road condition for nearby communities. This could occur along the access roads to the site on paved or unpaved roads. Induced Development Project activities may result in influx of people speculatively seeking employment. Other benefits may also occur locally where unforeseen businesses are established to cater for the project and workforce.
Human Rights	Supply Chain Impacts In certain contexts, there could be labour related impacts in the supply chain (IFC PS 2), such as potential impacts of forced or child labour. Such impacts may occur at the location of component and equipment manufactures and potentially their sub-suppliers (e.g. of raw materials). Supply chain impacts are further discussed in Chapter 4 of this ESIA Addendum.
Climate Change	Supply Chain Impacts The production of equipment and components for the project and delivery of equipment and materials to the site will result in embedded GHG emissions (Scope 3), that have the potential to act at a global level.

3 REGULATORY FRAMEWORK

The following chapters present the regulatory requirements for conducting an ESIA in accordance with national and lender regulations and standards.

3.1 Institutional Framework

The Project will be required to comply with all applicable environmental and social laws, regulations, policies, standards, and guidelines that form KSA's regulatory framework. In doing so, the process of environmental and social impact identification and evaluation will need to demonstrate that the Project can comply with such criteria during both the construction and operational phases. The Project will adopt and comply with the following regulations and standards:

- National regulations and standards.
- International and Regional Treaties ratified by the KSA, and
- Guidelines and standards as adopted by Project lenders, including EP IV (2020), IFC Performance Standards (2012), as well as the general and applicable industry specific WBG/IFC EHS Guidelines.

The stakeholders involved in the implementation of the institutional framework for the Project include MEWA and the new National Environmental Centres that fall under MEWA's remit which include NCEC. The following: ACWA Power, Project Company, the Engineering, Procurement and Construction (EPC) Contractor(s) and Operation and Maintenance (O&M) Company are also responsible for ensuring adherence to and implementation of the institutional framework.

3.1.1 Ministry of Environment, Water and Agriculture

MEWA is a government ministry in KSA responsible for overseeing environmental protection, water resources management, and agricultural development in the country. MEWA is responsible for developing and implementing policies and regulations to protect the environment, conserve biodiversity, and mitigate the impact of human activities on ecosystems. The ministry works towards preventing pollution, managing waste, and promoting sustainable practices in various sectors, including industry, agriculture, and transportation.

3.1.2 National Centre for Environmental Compliance (NCEC)

The NCEC has been the environmental regulator in KSA since 1st January 2021. NCEC is responsible for the issuing and renewal of environmental licenses for Category 1, 2 and 3 projects in accordance with the KSA Environmental Law and applicable MEWA Executive Regulations. NCEC review the environmental studies to determine the potential environmental

impacts of proposed projects and provide recommendations or conditions for approval to ensure that environmental concerns are addressed. NCEC also monitors various industries, activities, and projects to ensure they comply with environmental regulations and standards.

3.1.2.1 National Environmental Centres

In addition to the NCEC which has superseded GAMEP as the Environmental Regulator in KSA, the following National Centres have also been established and have their own policies and standards which need to be followed where applicable.

- National Centre for Meteorology (NCM): Monitors weather and climate conditions, prepares forecasts, provides airports, ports and other bodies with data and weather forecasts, and operates regional weather monitoring stations;
- National Centre for Wildlife (NCW): Supervises programmes related to the protection and development of wildlife and biological diversity, as well as planning and managing protected areas and managing centres for the breeding and resettlement of endangered animals;
- The National Centre for the Development of Vegetation Cover and Combating Desertification (NCVC): NCVC will develop and manage national parks, develop and rehabilitate vegetation cover in forests, protect local endangered plant species, combat desertification and conducting studies and supporting research related to vegetation; and
- National Centre for Waste Management (MWAN): Organizes the waste management sector to improve the quality of services, enhances the level of capabilities and competencies, enhances the economic sustainability of the sector by stimulating investment and maximizing the participation of the private sector, and reduces waste disposal in landfills by stimulating the use of best practices in resource recovery.

3.1.3 Project Lenders

The Project is seeking project finance from international lenders understood to require compliance with the EPs, IFC PSs and the applicable WBG EHS Guidelines.

The lenders require projects to conduct an environmental and social assessment to address the relevant environmental and social risks and impacts of the proposed Project.

3.2 Organisational Framework

3.2.1 National Laws, Regulations, Standards and Requirements

3.2.1.1 Basic Law of Governance 1992

The Basic Law of Governance (Royal Decree No. A/90 dated 27/08/1412H) is commonly referred to as the Constitution of Saudi Arabia. Article 32 of the Basic Law states: 'The State shall preserve, protect and improve the environment and prevent its pollution'.

3.2.1.2 National Environmental Law 2020

The previous national KSA legislation, the General Environmental Regulations (GER) (2001) has been superseded by the National Environmental Law (July 2020) and Executive Implementing Regulations (January 2021).

3.2.1.3 MEWA Executive Regulations

The new Environmental Law issued under Royal Decree M/165 of 19th Dhul Qada 1441 Hejra in July 2020 will be supported by new Executive Regulations which became law in June 2022. The law consolidates and supersedes much of the existing national legislation including the GER and conservation legislation into one law. These include:

- The Executive Regulations for Environmental Permits for the Construction and Operation of Activities;
- The Executive Regulations for Environmental Inspection and Auditing;
- The Executive Regulations for Air Quality;
- The Executive Regulations for Noise;
- The Executive Regulations for Preventing and Treating Soil Contamination;
- The Executive Regulations for Protecting the Aquatic Media from Pollution;
- The Executive Regulations for Sustainable Management of the Marine and Coastal Environment
- The Executive Regulations for Ozone Depleting Substances (ODS) and Hydrofluorocarbons (HFCs);
- The Executive Regulations for Environmental Rehabilitation of Degraded Sites and Treatment of Contaminated Sites;
- The Executive Regulations for Controls and Procedures Pertaining to Financial Dues for Environmental Licenses, Permits, and Services;
- The Executive Regulations for Hunting Terrestrial Wildlife Species;
- The Executive Regulations for Logging;
- The Executive Regulations for Development of Vegetation Cover Development and Combating Desertification;
- The Executive Regulations for Apprehension of Violations and Imposing Penalties.
- The Executive Regulations for Preparing and Implementing Preparedness and Response Plans for Emergencies and Environmental Disasters.

3.2.1.4 Waste management system

The waste management system issued pursuant to Royal Decree No. (M/3) dated 1/5/1443 AH/August 2021 and Council of Ministers Resolution No. (11) dated 1/2/1443 AH. The system

aims to regulate waste collection, transportation, sorting, storage, import, export, treatment and safe disposal activities, including aftercare of waste disposal sites. Everyone who practices in an activity related to waste management must provide the best environmental and economic results, according to the following priorities: recycling, resource recovery, and safe disposal.

The waste management system is supported by the executive regulations for waste management issued by Ministerial Resolution No. 332291/1, dated 10/18/1443 AH, which aims to clarify the executive frameworks of the system, such as provisions for licenses and permits, waste generator responsibility, and other waste management standards that must be applied.

3.2.1.5 Environmental Standards

The applicable environmental standards for the Project as per the national regulations and lender guidelines are outlined in Appendix C. These standards require project compliance. Where there is contradiction in limits between national standards and lender guidelines, the most stringent will apply.

In accordance with lender requirements, where specific national standards do not exist, a good practice standard should be applied.

3.2.1.6 National ESIA Requirements and Approval

Projects within KSA with potential to cause environmental impacts are subject to an ESIA as part of the planning and permitting process in accordance with the National Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH and as described in the Executive Regulations on Environmental Permits for the Construction and Operation of Activities of the Ministry of Environment, Water & Agriculture (MEWA).

Whilst all major development projects are required to pass through the ESIA process, the level of reporting and detail required is subject to classifying the project into three (3) individual classes based upon their predicted impacts. The table below provides further detail on these classes as described in the relevant Environmental Regulations.

The Executive Regulation on Environmental Permits for the Construction and Operation of Activities refer to NCEC as the Competent Authority, who is responsible for ensuring the environmental protection of KSA and implementing legislation as required. The Competent Authority is able to delegate responsibility of issuing approvals to other government authorities.

Table 3-1 ESIA Classes as per the Executive Regulation on Environmental Permits for the Construction and Operation of Activities

Class	Details
C1	Projects with Limited Environmental Impacts Covers projects that are not expected to have tangible adverse environmental and social impacts.

Class	Details
	Require submission of an Environmental Management Plan and Environmental Rehabilitation Plan to NCEC.
C2	Projects with Significant Environmental Impacts Covers projects that are likely to have some adverse environmental and social impacts which can be substantially mitigated and will not significantly impact areas beyond the site boundary. Require submission of an ESIA to NCEC as per Article 7 of this executive regulation.
C3	Projects with Serious Environmental Impacts Covers projects that are likely to have significant adverse environmental and social impacts, which cannot be fully mitigated, and likely affect areas beyond the site boundary. Require submission of an ESIA to NCEC as per Article 8 of this executive regulation.

3.2.1.7 NCEC Permitting and Approvals Process

Under the National Environmental Law 2020 and as described in the Implementing Regulations on Environmental Permits for the Construction and Operation of Activities, the environmental permitting and approval process for Class 3 Projects includes the following key stages:

- Stage 1: Applicant to identify relevant category of the development and to complete the related Environmental Classification Form;
- Stage 2: Submission of Environmental Classification Form to NCEC by Applicant;
- Stage 3: NCEC review of Environmental Classification Form (ECF) and confirmation of activity classification to Applicant within 10 working days;
- Stage 4: Class 3 activity, Applicant prepares a Scoping Report in Accordance with Appendix 3 and submits to NCEC;
- Stage 5: NCEC reviews and provides feedback of Scoping Report to Applicant for Class 3 activities within 15 working days;
- Stage 6: Applicant prepares ESIA Report in line with the suggested structure and content outlined in Appendix 4 and submits the ESIA Report to NCEC;
- Stage 7: NCEC review and approval of ESIA Report and issuance Environmental Permit for the construction of the Project within a maximum of 60 working days. Re-submission may be required if information provided is deemed insufficient by NCEC. The Environmental Permit to commence construction works is valid for three (3) years, construction activities must commence within this time to avoid the requirement for a new permit;
- Stage 8: Applicant commences construction, ensuring all commitments, i.e., environmental reporting, are met and reported as required to NCEC throughout works; and
- Stage 9: EPC Contractor appointed by the applicant completes construction and applies for an Environmental Permit for operation activities. Prior to the issuance of the Environmental Permit for operation, NCEC will review the conditions of the construction Environmental Permit to ensure all requirements have been met and may undertake a

site inspection. If all information is satisfactory, NCEC will issue the Environmental Permit for operation. The duration of the operational permit will depend on the activity but will be no less than three (3) years and no more than six (6) years.

The timeframe to complete all stages detailed above will differ between developments, indicative timeframes for NCEC approval is provided in the Implementing Regulations.

Throughout all stages of the environmental permitting and approval process, liaison and consultation with MEWA, NCEC and other relevant National Centres should be undertaken by the NCEC registered environmental consultancy.

3.2.2 Regional Laws, Regulations, Standards and Requirements

KSA is signatory to several regional agreements related to the environmental and social aspects. Table 3-2 below lists those relevant to the Project.

Table 3-2 Regional Conventions and Protocols

CONVENTIONS, AGREEMENTS AND PROTOCOLS	DATE SIGNED	SUMMARY	APPLICABILITY TO THE PROJECT
Agreement for the Establishment for Arab Centre for the Studies of Dry and Barren Land	03/09/1968	The Centre was established to conduct regional studies on barren areas in Arab countries, including e.g. studies of soils, studies on the degree of soil erosion and studies on the geological and geomorphological aspects of the different areas.	The Project will implement the necessary mitigation to avoid soil erosion and contamination
The Convention of Conservation of Wildlife and its Natural Habitat in the Gulf Cooperation Council (GCC) Countries	30/12/2001	Legal agreement binding all GCC states to coordinate their activities towards the conservation of wildlife and natural habitats.	The Project will implement the necessary mitigation and monitoring to avoid where possible and reduce impact to terrestrial ecology.

3.2.3 International Laws, Regulations, Standards and Requirements

The Project will be seeking financing from one of more financial institutions who:

- Have their own internal E&S investment guidelines that align with or are similar to the IFC Performance Standards
- Are Export Credit Agencies and require compliance with the OECD Common Approaches; or
- Are members of the collective environmental and social agreements such as the Equator Principles.

It is noted that ACWA Power implements the E&S requirements of IFC on all its projects as such the Al-Morjan Two IPP must comply with the IFC Performance Standards and IFC EHS Guidelines as part of ACWA Power Internal E&S requirements.

The Equator Principles necessitate Project compliance with the IFC Performance Standards and EHS Guidelines. The key E&S requirements for financial institutions are summarised below.

3.2.3.1 Equator Principles

The Equator Principles (EPs) are voluntary set of guidelines for assessing and managing environmental and social risks in project financing and have become the project finance industry standards for addressing environmental and social issues in global project financing. The latest iteration of the EPs, EPIV, was released in October 2020.

In accordance with the EPs, for projects located in Non-Designated Countries (which includes KSA), the assessment process evaluates compliance with the applicable IFC Performance Standards and the EHS Guidelines.

The Equator Principles consist of the following 10 Principles, which must be applied by the lenders providing finance:

- 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
- Principle 10 - Reporting and Transparency

3.2.3.2 IFC Performance Standards

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

The 2006 version of the IFC Performance Standard was reviewed and made applicable to all new projects from 1st January 2012. The updated IFC Performance Standard reflect IFC's stronger commitment to climate change, business and human rights, corporate governance

and gender equality as well as strengthening the due diligence process for IFIs. Such updates include comparable labour terms for migrant and non-migrant workers, clarification of levels of stakeholder engagement, monitoring of supply chains and an enhanced focus on energy efficiency.

The following lists the IFC Performance Standards (2012):

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
- Performance Standard 2: Labour and Working Conditions
- 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

3.2.3.3 WBG/IFC EHS Guidelines

The EHS Guidelines have been set out by the IFC and the World Bank Group to provide general guidelines for its members when involved in a project or when providing financial support to a project. The EHS Guidelines serve as technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The following EHS Guidelines relevant to this Project include:

- General EHS Guidelines, Environmental:
 - Air Emissions and Ambient Air Quality;
 - Energy Conservation;
 - Wastewater and Ambient Water Quality;
 - Water Conservation;
 - Hazardous Materials Management;
 - Waste Management;
 - Noise; and,
 - Contaminated Land.
- General EHS Guidelines, Occupational Health & Safety:
 - General Facility Design and Operation;
 - Communication and Training;
 - Physical Hazards;
 - Chemical Hazards;

- Biological Hazards;
- Radiological Hazards;
- Personal Protective Equipment (PPE);
- Special Hazard Environment; and,
- Monitoring.
- Community Health & Safety:
 - Water Quality and Availability;
 - Structural Safety of Project Infrastructure;
 - Life and Fire Safety;
 - Traffic Safety;
 - Transport of Hazardous Materials;
 - Disease prevention; and
 - Emergency Preparedness and Response.
- Construction and Decommissioning;
 - Environment;
 - Occupational Health and Safety; and
 - Community Health and Safety.
- Industry Sector Guidelines:
 - EHS Guidelines for Wind Energy
 - EHS Guidelines for Electric Power Transmission and Distribution;

3.2.3.4 Lenders Project Categorisation

Note: Based on comments from the LTA, 5 Capitals is providing an opinion on Project Categorisation. However, in line with normal lending process the final categorisation will be determined by each lender based on their specific categorisation obligations.

In comparison against key indicators under the EPIV categorisation definitions, the Project although large scale is not unprecedented as there are other large wind farms in KSA, the region and globally. Based on the Project type most impacts would be largely reversible once the project is decommissioned. There are some impacts that are potentially significant during construction and operations, including landscape & visual impacts and there are expected to be potential impacts to avifauna & bats, although it is largely understood from the original ESIA that the Project is not on a major flyway. The majority of other impacts can be addressed through site specific mitigation during construction and operations respectively.

Based on this justification, the Project would likely fit more closely with the Category B definition of the Equator Principles.

3.2.4 International and Regional Conventions / Protocols

KSA is signatory to several international and regional agreements related to the environment and social. The table below lists those relevant to the Project.

Table 3-3 International and Regional Conventions and Protocols

CONVENTIONS, AGREEMENTS AND PROTOCOLS	DATE SIGNED / RATIFIED	SUMMARY
Convention Concerning the Protection of the World Cultural and Natural Heritage	23/11/1972	Established to protect and enhance cultural and natural heritage, whilst there has been a focus on United Nations Educational Scientific and Cultural Organisation (UNESCO) designated sites the convention requires member states to protect all relevant resources and specifically states. that because a resource is not listed it should not be implied that the resource has no value.
Convention on International Trade in Endangered Species of Wild Fauna and Flora and Subsequent Amendments	03/03/1973	Established to identify species at risk and control trade in endangered species
Convention of the Conservation of Migratory Species of Wild Animals and all Amendments (Bonn Convention)	23/06/1979	An international agreement that aims to conserve migratory species throughout their ranges. This covers a wide range of species, including birds, marine mammals, sea turtles and bats. Requires member states to preserve and protect species and habitats which occur regularly in their area.
International Plant Protection Convention (1979 Revised Text)	28/11/1979	A convention established to protect the genetic resources of native plant species for agricultural and biological conservation purposes.
Protocol Concerning Regional Cooperation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency	14/02/1982	Contracting Parties undertake to cooperate in combatting pollution by oil and other harmful substances and maintain and promote contingency plans.
United National Convention on the Law of the Sea (UNCLOS)	10/12/1982	An international agreement that establishes a legal framework for all marine and maritime activities for all signatories.
Vienna Convention for the Protection of the Ozone Layer	22/03/1985	A multilateral environmental agreement that provided frameworks for international reductions in the production of chlorofluorocarbons due to their contribution to the destruction of the ozone layer, resulting in an increased threat of skin cancer.
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	10/09/1998	The Rotterdam Convention is an international treaty designed to facilitate informed decision-making by countries with regard to trade in hazardous chemicals.
Montreal Protocol on Substances that Deplete the Ozone Layer and All Amendments	16/09/1987	Established to reduce emissions of chemicals harmful to the upper ozone layer.
Basel Convention on the Control of Transboundary	22/03/1989	The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes.

CONVENTIONS, AGREEMENTS AND PROTOCOLS	DATE SIGNED / RATIFIED	SUMMARY
Movements of Hazardous Wastes and their Disposal		Includes restrictions on exporting of wastes but also includes requirements on member states to minimise production of hazardous waste and manage appropriately regardless of disposal location.
Paris Agreement to the United Nations Framework Convention on Climate Change (UNFCCC)	12/03/2016	UNFCCC is the main convention addressing the impacts and causes of climate change and aimed at returning global temperatures to a level which will not cause irreversible significant harm to ecosystem functioning.
United Nations Convention on Biological Diversity	05/06/1992	An international legally binding treaty with three (3) main objectives: conservation of biodiversity, sustainable use of biodiversity, fair and equitable sharing of the benefits arising from the use of genetic resource. The overall goal is to encourage actions which protect wildlife and ecosystems and lead to a sustainable future.
Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa	17/06/1994	Aims to conduct research and prevent/reverse desertification of natural habitats.
Convention for the Protection of the World Cultural and Natural Heritage	23/11/1972	Established to protect and enhance cultural and natural heritage, whilst there has been a focus on UNESCO designated sites the convention requires member states to protect all relevant resources and specifically states that because a resource is not listed it should not be implied that the resource has no value.
Kyoto Protocol to the (United Nations) UN Framework Convention on Climate Change	11/12/1997	Annex I parties of the framework agreed to commitments with a view to reducing their overall emission of six (6) greenhouse gases by at least 5% below 1990 levels between 2008 and 2012. Established emissions trading and a clean development mechanism.
Cartagena Protocol on Biosafety to the Convention on Biological Diversity	29/01/2000	Relates to the transfer and use of living modified organisms and may apply to any hybrid species which are imported for planting if genetically modified.
Stockholm Convention on Persistent Organic Pollutants (POPs)	25/06/2012	A global treaty to protect human health and the environment from persistent organic pollutants (POPs). Requires member states to eliminate use of Persistent Organic Pollutants, mainly focused on herbicides but now extended to other substances.
Convention on the Rights of Persons with Disabilities (CRPD) and its Optional Protocols	13/12/2006	International human rights treaty intended to protect the rights and dignity of persons with disabilities.

3.2.4.1 ILO Conventions

KSA is signatory to six of ten fundamental conventions under the International Labour Organization (ILO), namely:

- Forced Labour Convention (C029 of 1930 ratified in June 1978);

- Equal Remuneration Convention (C100 of 1951 ratified in June 1978);
- Abolition of Forced Labour Convention (C105 of 1957 ratified in June 1978);
- Discrimination (Employment and Occupation) Convention (C111 of 1960 ratified in June 1978);
- Minimum Age Convention (C138 of 1973 ratified in April 2014); and
- Worst Forms of Child Labour Convention (C182 of 1999 ratified in October 2001).

The four fundamental ILO conventions that Saudi Arabia is not signatory to include¹:

- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize of 1948.
- ILO Convention 98 on the Right to Organize and Collective Bargaining of 1949.
- ILO Convention 155 on Occupational Safety and Health of 1981.
- ILO Convention 187 on Promotional Framework for Occupational Safety and Health of 2006.

KSA is signatory of one of four priority Governance Conventions, the Labour Inspection Convention C081 of 1947 ratified in June 1978 and 11 of 178 technical conventions.

¹ Retrieved from:
https://www.ilo.org/dyn/normlex/en/f?p=1000:11210:0::NO:11210:P11210_COUNTRY_ID:103208

4 LAND USE AND SOCIO-ECONOMICS

4.1 Standards and Regulations

4.1.1 National Context and Regulations

There are no statutory requirements in KSA's legal system for land acquisition and resettlement related to informal land users. Processes are in place for legal title holders only.

4.1.2 Lenders Requirements

IFC PERFORMANCE STANDARD 5-LAND ACQUISITION AND INVOLUNTARY RESETTLEMENT

This standard recognises that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) because of project-related land acquisition and/or restrictions on land use. Where involuntary resettlement is unavoidable, it should be minimised, and appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.

4.2 Baseline

4.2.1 Land Ownership

The land is owned by the Saudi Arabian Ministry of Energy and is Head Leased to SPPC who will lease the land to the Project Company. Therefore no land acquisition is required for the Project.

4.2.2 Land Use at and near the Project Site

The Starah 2000 MW Wind Project is located approximately 60 km northwest of the city of Layla in Governate of Al Aflaj, Riyadh Region of KSA. There are two communities near the Project site, Al Ahmer and Al Haddar, 11 km east and 6 km south to the Project site, respectively. The Project is primarily located on a ridge, and under the cliff, there is a farm 3 km north of the Project site.

During a joint rapid site visit on April 15th, 2025, conducted by 5 Capitals and ACWA Power, the site was observed for signs of any settlements, herders, and any other land use.

There is one gravel road parallel to the existing OHTL as indicated in the figure below. The closest paved road runs 3 km north to the Project site. It is expected that all project activities

will be within the limits of the Project boundary, specifically at WTG sites, access roads, and temporary construction facilities, so it is expected that the project's footprint will be limited to these areas.

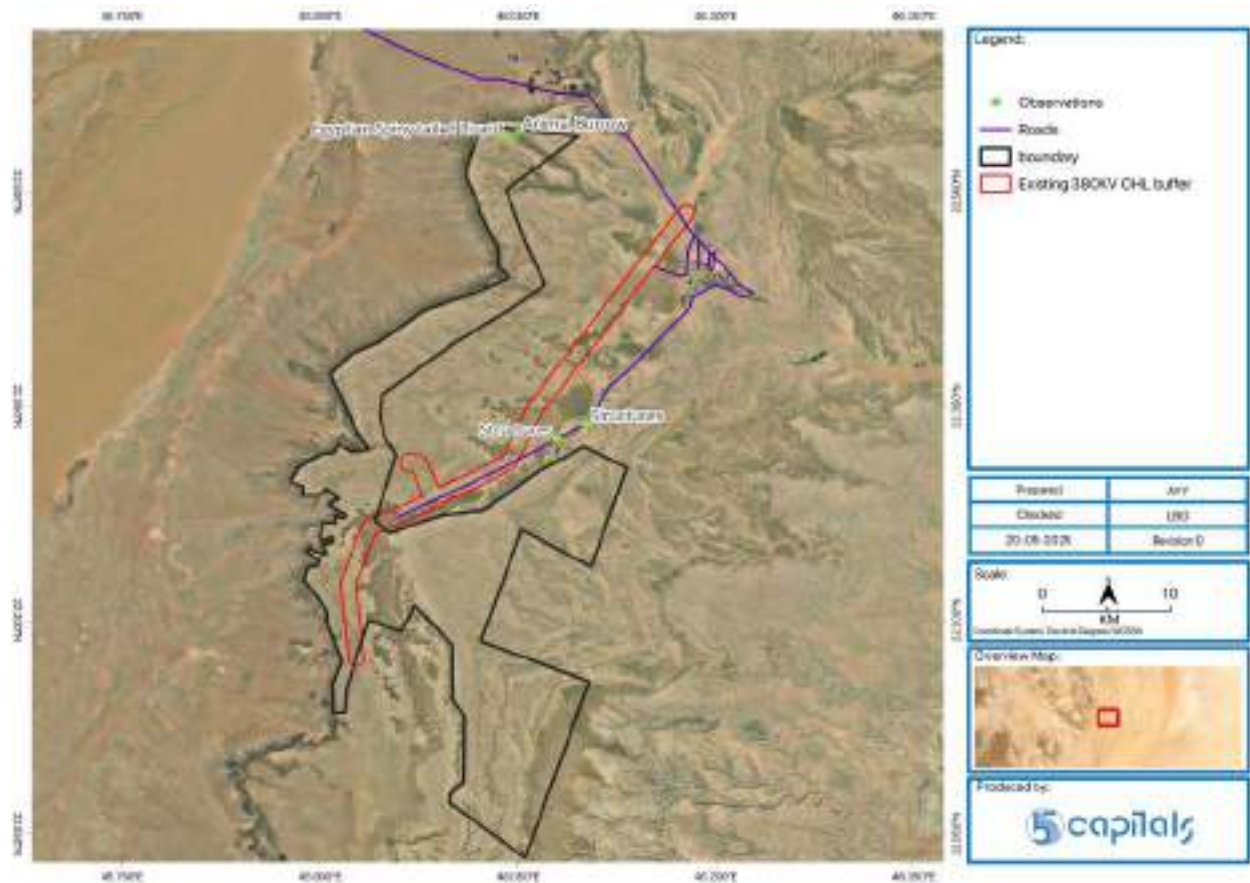


Figure 4-1 Observations at Project Site

No settlements or structures were identified within the boundaries of the Project site. As per the ESIA and the surveys that were carried out by Ali Harbi Consulting in 2022, the area was used for camel grazing; however, no livestock or active grazing were observed at the time of 5 Capitals site visit. The land is predominantly a barren, rocky landscape with small areas of vegetation and very few trees. The Project is located primarily on a ridge and the west side of the Project area lies on the edge of a cliff. Wadis were also observed within the Project site. The typical landscape of the Project site can be seen in the figures below.



Figure 4-2 Typical Landscape at the Project Site

Due to accessibility issues and time constraint, it was not possible to cover the whole site, and only the northern and middle parts of the site were visited. An animal burrow and an Egyptian Spiny-tailed Lizard, *Uromastix aegyptia*, (classified as Vulnerable (VU) on the IUCN Red List and by the National Center for Wildlife in KSA) was found at two separate areas in the northern part of the site, as indicated by the figure below.



Figure 4-3 An animal burrow (22° 32' 30.222" N, 46° 3' 2.47" E) and an Egyptian Spiny-tailed Lizard (22° 32' 16.242" N, 46° 2' 28.62" E) on the Project Site

Prior to the site visit, 5 Capitals prepared a consultation questionnaire in line with the stakeholder engagement guidelines (See Appendix A) for ACWA Power and 5 Capitals to engage with people on or adjacent to the Project site, should any be observed. It was important to consider the complex cultural context in Saudi Arabia when preparing the questionnaire, and hence the extent and type of questions was tailored to suit this.

Contrary to the findings of the ESIA conducted in 2022, there were no settlements, structures, herders, livestock, or signs of grazing observed within the Project boundary during the site visit. A local resident at the SEC substation construction site (location indicated in Figure 1-1) informed the site visit team that people tend to avoid the higher areas with cliffs (where the turbines will be located) due to safety concerns, and that there is no herding activity in any part of the Project site. Some structures and animal enclosures were found outside of the Project boundary by the side of the gravel road as indicated in Figure 3-1 and 3-4. Despite the proximity shown on the map, it is noted that the turbines at the southern part of the Project site will be located on the ridges above and behind the structures. Therefore, the community and the owners of the structures are not likely to access the Project site. In addition, patches of dense vegetation often occur at lower areas due to high availability of groundwater, thus elevated areas are less preferable for herding.



Figure 4-4 Identified structures

Although no herders or livestock were observed within the Project boundary during the visit, the ESIA indicated that parts of the project area may be used for grazing. In KSA, it is common practice for herders to utilise undeveloped lands for grazing without formal contracts. However, this informal usage is generally understood to be temporary, as these herders are typically nomadic with the ability to easily relocate due to the vast expanse of very similar landscape and vegetation in proximity.

4.2.3 Indigenous Peoples

The legislation of the KSA does not recognize any segment of the local population as meeting the essential qualification criteria for Indigenous Peoples. The population of Saudi Arabia is considered homogenous and predominantly Arab and Muslim. The World Directory of Minorities and Indigenous Peoples indicates that there are no Indigenous Groups listed for Saudi Arabia however it lists some religious minorities including Shi'is, Isma'ilis and Zaydis Muslims. Shi'a, estimated at 10-15% of the population (though some estimates suggest their numbers may be as high as 25%) are mainly in the Eastern Province or 'Ash Sharqiyah' with communities elsewhere as well. Isma'ilis are mainly in the region of Najran while the Zaydis live on the borders with Yemen (Saudi Arabia - World Directory of Minorities & Indigenous Peoples, 2024)². However, these minorities are not characterized by nationally distinct ethnic backgrounds, exclusive and aggregated historical attachment to natural resource bases and customary community-level autonomy, and they are demonstrably well integrated into the mainstream population. Also, Indigenous People were not identified for Saudi in the Indigenous World 2024 Report issued by the International Work Group for Indigenous Affairs (IWGIA)³, which is a global human rights organisation dedicated to promoting, protecting and defending Indigenous Peoples' rights, with broad-based expertise on Indigenous Peoples and broader social inclusion.

² <https://minorityrights.org/country/saudi-arabia/>

³ <https://iwgia.org/en/resources/publications/5508-the-indigenous-world-2024.html#:~:text=This%20yearly%20overview%20serves%20to,of%20the%20Indigenous%20Peoples'%20struggle.>

4.3 Potential Project Impacts

4.3.1 Land Use Change

At the time of the site visit in April 2025, no herders or animals were observed within the Project site. All project activities will be within the limits of the Project boundary, specifically at WTG sites, access roads, and temporary construction facilities. Most turbines will be installed on the ridges where no herding activity takes place, and the site will still be largely accessible during the operational phase.

The area being used for grazing within the Project site is understood to be limited as most of the Project site was observed to be an open rock and gravel habitat with little vegetation.

Given the abundance of open, available land outside of the site within proximity, and expected grazing areas for camels available for use by herders, the impact of land loss due to the Project for grazing activities is expected to be minor.

Table 4-1 Summary of Pre-mitigated Impact on Land Use

IMPACT	LAND USE CHANGE				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Limited to WTGs footprint and construction areas and associated facilities				
Impact Frequency	During construction and operational phases				
Impact Likelihood	Unlikely	Possible		Likely	
Impact Magnitude	Negligible	Small		Medium	Large
Impact Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor		Moderate	Major
Significance of impact is considered Negligible .					

4.3.2 Relocation and Livelihood

No settlements or mobile camps were observed on the areas of the site that were covered during the site visit. The ESIA states that there are structures without providing photo evidence or location. If there is any structure on site that was not detected during the site visit, it is likely to be a mobile camp with herders that move on a regular basis.

If the site is indeed used for grazing, even though no livestock was observed during the site visit, it is likely that herders and their livestock would relocate to alternative pastures, allowing herding to continue without disruption. If herding continues as per normal, the incomes of the livestock owners and their employees will not be impacted by the Project.

Table 4-2 Summary of Pre-mitigated Impact on Relocation and Livelihood

IMPACT	RELOCATION AND LIVELIHOOD				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Limited to WTGs footprint and construction areas and associated facilities				
Impact Frequency	During construction phase				
Impact Likelihood	Unlikely	Possible		Likely	
Impact Magnitude	Negligible	Small		Medium	Large
Impact Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor		Moderate	Major
Significance of impact is considered Negligible .					

4.3.3 Access

Within the Project site, there were very few vehicle tracks, and it was challenging to drive on site due to the prevalence of sharp rocks. During the consultation with the local resident, it was established that the site is not used as a transportation route. The Project will not impact the roads near the Project site, therefore any vehicles that use the roads as access route can continue to do so during and after the Project is constructed.

Table 4-3 Summary of Pre-mitigated Impact on Access

IMPACT	ACCESS			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Limited to WTGs footprint and construction areas and associated facilities			
Impact Frequency	During construction and operational phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		Medium | Large
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		Moderate | Major
Significance of impact is considered Negligible.				

4.3.4 Ecosystem Services

Ecosystem services are the benefits that people, including businesses derive from ecosystems. A decline or loss of any of these services and their benefits can result in socio-economic impacts that extend beyond environmental damages (World Resources Institute, 2013). These are organised into: (i) provisioning services which are products people obtain from the ecosystem (ii) regulating services which are benefits people obtain from regulation of ecosystem services (iii) cultural services which are non-material benefits from the ecosystem (iv) supporting services which are natural processes that maintain other services (IFC PS6). These are discussed below in the context of the Project site and its area of influence.

Provisioning Services - The direct area of influence of the Project is not considered to be host to natural resources that may be considered ecosystem services. For example, the site does not provide food, fuel or other raw materials to the local or the wider population.

Regulating Services – The Project site consists of sparse vegetation and therefore does not support any considerable regulating services such as erosion control, temperature regulation or carbon sequestration.

Cultural services – The desert environment at the Project site does not provide any non-material benefits from the ecosystems, such as contributing to cultural identity, spiritual enrichment or tourism.

Supporting services – There are certain supporting services such as nutrient cycling, primary production and soil formation that are applicable for the Project site, however these foundational processes are expected to continue to function effectively despite potential disturbances from Project activities.

Considering the construction and operational aspects of the Project, any impacts that will result in major impacts to ecosystem services have not been identified. As such, the Project is not expected to result in any notable changes to ecosystem services dependencies that requires a detailed analysis.

The ecosystem services available to (and in use by) humans at the Project site are limited, primarily due to the lack of land users, lack of valuable vegetation, or other ecological features that are commonly used to derive benefits.

Based on the site observations and details provided in sections above, the habitat is of low grazing importance due to the lack of substantial suitable vegetation. There were limited observed trees on site that would produce substantial firewood provisions. In areas of thicker vegetation, shrubs were most predominant, which give little to no firewood provision. The habitat is representative of typical large regional arid ecosystems within KSA, and the loss in ecosystem services are envisaged to be minimal.

Therefore, the Project site will not impact any significant ecosystem services.

Table 4-4 Summary of Pre-mitigated Impact on Ecosystem Services

IMPACT	ECOSYSTEM SERVICES				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Limited to WTGs footprint and construction areas and associated facilities				
Impact Frequency	During construction phase				
Impact Likelihood	Unlikely	Possible		Likely	
Impact Magnitude	Negligible	Small		Medium	Large
Impact Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor		Moderate	Major
Significance of impact is considered Negligible.					

During the operational phase, most of the Project land is accessible except for the WTG areas and the O&M offices. Therefore, there is minimal impact on land use and related impacts.

4.4 Mitigation Measures

To reduce potential land use and social impacts, appropriate measures should be implemented. The table below presents the relevant mitigation measures.

Table 4-5 Land Use and Social Impacts Mitigation Measures

IMPACT	MITIGATION
Land Use Change	No land users were encountered during the site visit. Given the abundance of open, available, similar land outside of the site within proximity, the loss of land due to the Project for grazing activities is expected to be minimal. However, a robust grievance mechanism should be implemented to ensure that any complaints or concerns raised by the stakeholders (including those in regard to any claims of displacement or impact to their livelihood), particularly herders, are acknowledged, addressed and closed out in a timely manner.
Relocation	- No structures or livestock was observed within the Project site. If encountered later, the owners of structures will be provided with support and sufficient time to identify and move to a suitable relocation site for their livestock. Monitoring will be undertaken to ensure that the herders have been able to successfully re-establish their activities at the new relocation site. - Should any issues arise with construction disrupting herders near the Project site, the concerned work will pause until a resolution is found (see section below on details of the grievance mechanism).

IMPACT	MITIGATION
Livelihoods (owners of livestock and their herders/workers)	All the livestock owners and their workers will have access to the grievance mechanism (see section below on details of the grievance mechanism).
Access	The Project will not obstruct any access routes outside of the Project boundaries.
Ecosystem Services	- The Project activities will be restricted within its boundaries to ensure that there is no impact on areas outside its Area of Influence (Aoi). - The removal of vegetation and the cutting of trees will be avoided where feasible.

4.4.1 Access to the Grievance Mechanism

If there are herding activity within the Project site not detected during the site visit, or if livestock move onto the Project site after the site visit, livestock owners and their herders/workers will have access to the Grievance Redress Mechanism (GRM) throughout the Project's lifespan in line with the Project Stakeholder Engagement Plan (SEP). This will allow them to raise any concerns or issues they have in relation to the Project. The details of the Project GRM will be posted in strategic locations in both Arabic and English, where it is visible to external stakeholders including herders.

The GRM established for the Project will allow for:

- Verbal complaints/concerns received in person or through phone calls; and
- Written complaints/concerns received through emails or grievance boxes located:
 - At the main gate of offices;
 - At the gate of the temporary site facilities; and
 - Around the site.

The grievance mechanism will allow parties to raise concerns or complaints against the Project without cost, retribution, or fear of negative consequences.

4.5 Monitoring

Table 4-6 Land Use and Social Monitoring Requirements – Construction and Operation

MONITORING	PARAMETER	FREQUENCY & DURATIONS
External Party Grievances	Issues Concerning Socioeconomic Factors or Land Use/Ownership	On-going

5 HUMAN RIGHTS IMPACTS ASSESSMENT

5.1 Overview

With new requirements under EP IV, an increased attention is being given to the accountability of businesses for their impact on human rights and it necessitates the inclusion of a 'Human Rights Impact Assessment' as part of the ESIA for projects financed by Equator Principles Financial Institutions (EPFIs). Accordingly, a Human Rights Impact Assessment has been conducted to evaluate:

- The rights of the local community and herders who live and work in the surrounding area to a healthy, safe, and secure environment;
- The rights of the labourers to adequate healthy and safe living conditions; and
- The rights of the labourers to healthy, safe, and fair working environments and conditions.

5.2 Standards and Regulations

5.2.1 National Context and Regulations

Saudi labour law is governed by Royal Decree No. M/51 (23 Sha'ban 1426 / 27th September 2005). The labour law includes terms and conditions of employment in Saudi Arabia required by employers and includes details of worker rights.

The Ministry of Labour (MOL) approved amendments to the Labour Law on 5th April 2015 (Resolution No. 258) which was first published in the official gazette on 24th April 2015.

The Ministry of Labour and Social Development was later merged with Ministry of Civil Service to establish the Ministry of Human Resources and Social Development in 2019, which is the governing Ministry in Saudi Arabia responsible for providing development, support, and protection for the community.

Section 26 of the Basic Law of Governance states the Government is responsible for protecting human rights in accordance with the Shari'a Law that governs the country. Human Rights treaties ratified by the Kingdom include (Treaty Body Database, 2020):

- Convention against Torture and Other Cruel Inhuman or Degrading Treatment or Punishment (23 September 1997);
- Convention on the Elimination of All Forms of Discrimination against Women (7 September 2000);

- International Convention on the Elimination of All Forms of Racial Discrimination (23 September 1997);
- Convention on the Rights of the Child (26 January 1996);
 - Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict (10 June 2011);
 - Optional Protocol to the Convention on the Rights of the Child on the sale of children child prostitution and child pornography (18 August 2010);
- Convention on the Rights of Persons with Disabilities (24 June 2008);
- The Arab Charter of Human Rights; and
- Geneva Convention (18 May 1963).

In addition, Saudi Arabia is an International Labour Organisation (ILO) member state and has ratified 16 ILO Conventions out of which 6 are part of the IFC Performance Standard 2 – Labour and Working Conditions.

5.2.2 Lender Requirements

IFC PERFORMANCE STANDARD 4-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 minimise the risks and impacts to community health, safety, and security that may arise from Project related activities, with particular attention to vulnerable groups.

IFC PERFORMANCE STANDARD 2-LABOUR AND WORKING CONDITIONS

IFC PS2 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).

PS2 is in part guided by several 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 (ratified by KSA);
- ILO Convention 100 on Equal Remuneration (ratified by KSA);
- ILO Convention 105 on the Abolition of Forced Labour (ratified by KSA);
- ILO Convention 111 on Discrimination (Employment and Occupation) (ratified by KSA);

- ILO Convention 138 on Minimum Age (of Employment) (ratified by KSA);
- ILO Convention 182 on the Worst Forms of Child Labour (ratified by KSA);
- 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, PS2 outlines certain requirements for projects linked to Human Resource (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 and safety (OHS) management, and grievance redress.

UNITED NATIONS HUMAN RIGHTS GUIDING PRINCIPLES (HRGPs)

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

IFC GUIDANCE ON GENDER BASED VIOLENCE AND HARASSMENT (GBVH) IN THE CONSTRUCTION SECTOR

The assessment, prevention, monitoring, and response measures with regards to GBVH should be underpinned by the following principles:

- **Survivor Centred:** The rights of GBVH survivors need to be consistently prioritised and used as the starting point for all decisions on efforts to assess, prevent, monitor, and respond to GBVH.
- **Safe:** Survivors, witnesses, and those who report and seek to address GBVH can be at risk of retaliation, including threatening and violent behaviour, often from those who do not like their position of power being challenged. Companies should prioritise the safety of those who have experienced, witnessed, and reported GBVH.
- **Context specific:** All measures need to be rooted in a thorough understanding of the local context. Investors and companies should understand the legal and social context, and identify the support mechanisms that are in place.
- **Collaborative:** Companies should seek inputs from a range of internal and external stakeholders to increase the likelihood of broader buy-in and make GBVH prevention more effective.
- **Inclusive:** Companies should recognise the heightened risks of GBVH faced by certain groups who are subject to discrimination and marginalisation. High risk groups often include people with disabilities, single parents, migrants and ethnic minorities, and sexual and gender minorities. The system should also account for illiterate or non-literate people who may not be able to access written information on GBVH reporting mechanisms.
- **Integrated:** Processes and efforts to assess, prevent, monitor, and respond to GBVH need to be integrated as much as possible into existing processes and management systems, such as occupational health safety, security management systems, environmental and social management systems (ESMS), and HR policies and procedures.
- **Non-discriminatory:** All survivors need to be listened to and treated equally whilst promoting diversity in the workplace.
- **Well-informed:** Companies should draw on relevant expertise when developing prevention and response measures. The grievance mechanism and investigation procedures should be set up to ensure they are appropriate, relevant, and safe in the local context.

According to the guidance, the benefits of addressing GBVH include:

- Improves workers' physical and emotional wellbeing and strengthens occupational health and safety.
- Avoids reputational damage, financial risks, and legal liabilities for companies, investors, and construction contractors.
- Builds relationships and social license to operate in communities. This can result from regular dialogue to understand and track project GBVH risks as well as the effective use of measures to prevent and respond to GBVH.

- Broadens the pool of potential workers that companies can draw upon, including women workers from nearby communities because of lower perceived risk of GBVH.

5.3 Project Affected People

5.3.1 Local Communities and Herders

As outlined earlier, The Project is located approximately 60 km northwest of the city of Layla in Governate of Al Aflaj, Riyadh Region of KSA. There are two communities near the Project site, Al Ahmer and Al Haddar, 11 km east and 6 km south to the Project site, respectively.

There is one gravel road parallel to the existing OHTL. The closest paved road runs 3 km north to the Project site.

The Project activities can potentially result in direct or indirect impacts to users of the adjacent road and the nearby communities, such as landscape and visual impacts and shadow flicker.

During the site visit on 15th April 2025 conducted by 5 Capitals and ACWA Power the site was observed for signs of settlements and herders. No signs of land use were noted on the Project site.

Note: Refer to the Land Use section above for further information.

5.3.2 Project Workers

There are estimated to be up to 1,100 workers on-site at the peak of construction. It is expected that most of the workers and staff will be expatriates, likely to be predominantly from China.

Where possible workforce will be sourced from nearest communities during the project construction phase. Non-local workforce, including unskilled workforce, administrative staff and engineers will be accommodated at the accommodation camp within the construction area.

During the operation phase, it is expected that there will be 150 workers, which will include Saudi nationals.

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

Accordingly, Project related activities, management processes, living conditions, and work environments can result in potential adverse impacts to employees and workers listed above.

5.4 Potential Project Impacts on Human Rights

5.4.1 Construction Phase

COMMUNITY SAFETY AND SECURITY

All construction projects have potential risks to public safety due to the use of high-powered equipment, heavy construction equipment, excavation activities, transportation, fire incidents, and pollution releases. Additionally, unauthorised access to the construction site, including the public presents a safety and security concern. As outlined earlier, there are two communities near the Project site, Al Ahmer and Al Haddar, 11 km east and 6 km south to the Project site, respectively. However, the overall risk is inherently low, as the nature of a wind project construction phase is not typically hazardous.

Public risks during the construction phase of a project have the potential to result in isolated incidents such as vehicle accidents and leaching of material from damaged WTGs, which could be highly dangerous to a person or group of people, however, this rarely occurs. Such impacts are very unlikely during this Project due to the distance from receptors, and lack of receptors.

It is noted that a Grievance Mechanism will be established for the Project to allow third parties to raise concerns or complaints against the Project without cost, retribution, or fear of negative consequences.

The Project will ensure that the right of local communities to a clean and safe environment is safeguarded through the implementation of mitigation and management measures detailed in the ESIA and this ESIA Addendum.

Table 5-1 Summary of Pre-mitigated Impact on Community Safety and Security

IMPACT	COMMUNITY SAFETY AND SECURITY				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Project site and settlements around the Project site				
Impact Frequency	During construction phase				
Impact Likelihood	Unlikely	Possible		Likely	
Impact Magnitude	Negligible	Small		Medium	Large
Impact Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor		Moderate	Major
Significance of impact is considered Minor.					

OCCUPATIONAL HEALTH AND SAFETY

Common activities undertaken during construction such as civil works, the movement of heavy machinery, excavation, welding, handling of chemicals, and works undertaken at height, in confined space or with electrical hazards etc. can introduce risk to the health and safety for the workforce. 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 depending on the construction methods employed and the degree of control implemented by the contractor. Health, Safety, and Environment (HSE) personnel will be on site during the project construction. These personnel will be dedicated HSE professionals to ensure the Engineering, Procurement and Construction (EPC) workers 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 during the construction phase.

In Saudi Arabia, working in extreme heat poses significant health and safety risks. This is addressed through the Midday Work Ban, a regulation enforced by the Ministry of Human Resources and Social Development, which prohibits outdoor work under direct sunlight between noon and 3:00 p.m. from 15 June to 15 September. This is to protect workers from heat exhaustion and heatstroke and is supported by penalties for non-compliance.

Table 5-2 Summary of Pre-mitigated Impact on Occupational Health and Safety

IMPACT	OCCUPATIONAL HEALTH AND SAFETY			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Construction area			
Impact Frequency	During construction phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Moderate.				

COMMUNICABLE DISEASES

Impacts on Workforce

The risk associated with the spread of communicable diseases within workforces is prominent in construction working environments that require the sharing of equipment, accommodation, sanitary facilities, canteens, and means of transportation between workers. A high number of

workers working in such proximity or confined spaces such as for this Project also increases the risk of infection.

The possibility of communicable disease is effectively reduced by the KSA compulsory the Iqama medical examination. Blood tests for HIV, hepatitis B, and hepatitis C, chest X-ray for tuberculosis, and general physical examinations are performed to ensure that work visa applicants are healthy and fit to work. In addition, the health of workers depends greatly on hygiene management of the EPC contractor on site, whose health and safety obligations are specified in the KSA Labour Law.

Impacts on Surrounding Community

The majority of the construction workers will stay in site camps within the Project area. However, the worker influx (total 1,100 workers at the peak of construction) may also have a possible impact on community health where integration with local communities takes place, should either party become infected with a communicable disease.

Table 5-3 Summary of Pre-mitigated Impact on Communicable Diseases

IMPACT	COMMUNICABLE DISEASES			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Project site and settlements around the Project site			
Impact Frequency	During construction phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Minor.				

WORKING CONDITIONS, WELFARE & ACCOMMODATION

Unfair wages, education, and opportunities among the workforce can result in opportunistic immoral practices with labourers and site staff who consequently suffer.

The quality of living accommodation, 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.) can significantly impact the lives and wellbeing of Project workers. This may include the 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.

Table 5-4 Summary of Pre-mitigated Impact on Working Conditions, Welfare & Accommodation

IMPACT	WORKING CONDITIONS, WELFARE, AND ACCOMMODATION			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Construction area			
Impact Frequency	During construction phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Moderate.				

WORKER AND 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 procedures for each concerning HR, labour/workforce employment, and other related elements.

However, labour exploitation on construction sites has been common for decades, especially in environments where the workers may not be part of a syndicate or a cooperative. Examples from other projects within the region have shown that there can be instances of forced labour, child labour, labour with poor contracting conditions, or lacking processes in place to manage such elements. Saudi Arabia's Labour Law explicitly prohibits exploitative practices such as forced labour and child labour to ensure ethical recruitment and employment practices. Child labour is effectively minimised with the standard KSA Iqama application process (as it requires official documents from workers home countries to prove date of birth prior to issuing labour permits), but other forms of exploitation such as forced labour with debt bondage can be harder to detect.

In addition, labour reforms were introduced in March 2021 to help ease restrictions and make changes to the present sponsorship system that lays down rules and regulations for migrant workers mobility as per Resolution No. 51848/1442. This reform stipulates that the employers are prohibited from withholding the workers' passports and that migrant workers can change jobs without their current employer's consent after completing one year of their contract, once their contract expires, in situations where the worker's work permit has expired, if the worker is not paid for three consecutive months, and if a labor dispute arises and the employer fails to attend two litigation hearings (HRW (a), 2021). Therefore, the risk of worker exploitation can be effectively reduced.

Recruitment is being undertaken by CEEC, which has prior experience delivering large-scale projects in Saudi Arabia. Potential risks exist regarding workforce exploitation and are expected to be more prevalent at lower ends of the Project hierarchy, particularly for sub-contractors and agency/contracted manpower that may need to be engaged.

Table 5-5 Summary of Pre-mitigated Impact on Worker and Workforce Exploitation

IMPACT	WORKER AND WORKFORCE EXPLOITATION			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Construction area			
Impact Frequency	During construction phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Moderate.				

GENDER INEQUALITY & DISCRIMINATION

Saudi Arabia has eliminated restrictions on women's employment in industrial sectors including construction, however, the construction industry remains lacking in gender diversity, being dominated by men. Women are generally more likely to face discrimination in terms of employment or wages, even when they engage in the same tasks as men.

Historically, income earning opportunities for women through direct employment during the construction phase or through indirect employment has the potential to increase household tensions and expose women to cultural pressure, or harassment and violence in their homes or communities. However, in recent years, the country has undergone significant social transformation, leading to notable improvements in opportunities and societal acceptance of women's participation in the workforce. The reality of the construction industry in the region is that it is male dominated and there will not be blue collar workers that are female. Females may however be involved in management positions, or other office-based roles; for which the necessary provisions for a female workforce would be required at the site.

ACWA Power integrates gender equality and non-discrimination into its corporate diversity and inclusion policies, including a zero-tolerance stance on harassment and gender-based violence.

The Project should guarantee the right of all Project workers including women to just and favourable work conditions, free of discrimination.

Table 5-6 Summary of Pre-mitigated Impact on Gender Inequality and Discrimination

IMPACT	GENDER INEQUALITY AND DISCRIMINATION			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Construction area			
Impact Frequency	During construction phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Moderate.				

GENDER BASED VIOLENCE AND HARASSMENT, SEXUAL EXPLOITATION & ABUSE, AND SEXUAL HARASSMENT

Members of the workforce, their family members, or the neighbouring communities can potentially face harassment in the workplace or at home in forms of GBVH, Sexual Exploitation & Abuse (SEA), and Sexual Harassment (SH). The influx of workers from outside of the Project region may increase the likelihood of GBVH. The constructions workers are likely to be predominantly young males coming from other regions and outside of the country. These workers will be away from their families and removed from their normal social spheres. This could potentially result in peer pressure and involvement in unlawful behaviour. Such behaviour can lead to unwanted aggressive advances and harassment.

During the construction phase, workers will also be vulnerable to various forms of harassment, exploitation, and abuse, which could be aggravated by the traditional male working environment.

Table 5-7 Summary of Pre-mitigated Impact on GBVH

Impact	GBVH			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Construction area			
Impact Frequency	During construction phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge

IMPACT	GBVH			
Impact Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
Significance of impact is considered Moderate .				

5.4.2 Operational Phase

COMMUNITY SAFETY AND SECURITY

Although they are expected to be minimal for a wind project, the Project will carry certain risks that could result in impacts to public or 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, Volatile Organic Compound (VOC) fumes, explosions, spills of back-up generator fuels, and un-warranted or accidental releases of sanitary wastewater. The extent of such impacts may range outside of the boundaries of the Project and require the involvement of external agencies to help manage and abate such impacts (e.g., Civil Defence, Police, and Army).

As outlined earlier, there are two communities near the Project site, Al Ahmer and Al Haddar, 11 km east and 6 km south to the Project site, respectively.

Potential risks can arise from unauthorised parties (including the public) accessing the Project, such as electrocution. Several measures are considered to reduce those risks including fencing the site, installing monitored gates, and hiring security guards either through a 3rd party or direct employees of the company to prevent the public from trespassing to the site and any malicious intrusion during operation.

Table 5-8 Summary of Pre-mitigated Impact on Community Safety and Security

IMPACT	COMMUNITY SAFETY AND SECURITY				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Settlements around the Project				
Impact Frequency	During operational phase				
Impact Likelihood	Unlikely	Possible		Likely	
Impact Magnitude	Negligible	Small		Medium	Large
Impact Sensitivity	Low	Medium		High	
Impact Significance	Negligible	Minor		Moderate	Major
Significance of impact is considered Minor.					

OCCUPATIONAL HEALTH AND SAFETY

The risks generally 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 vehicles, equipment, and machinery. During the operational phase there will be a limited workforce (150 people), and their work will involve cleaning of the blades and turbine towers, greasing and changing oil of gearboxes, and other maintenance work of substations, transmission lines, and roads. There remain occupational health and safety risks attributable to the operational phase associated with maintenance and inspection requirements.

The severity and likelihood of risks during the operational phase will also depend on the frequency and requirements for planned and unplanned maintenance. The O&M team should develop and implement a robust plan to appropriately manage these risks.

A grievance mechanism has been established for the Project and will be implemented to allow employees to express their concerns or complaints without cost, retribution, or fear of negative consequences.

Table 5-9 Summary of Pre-mitigated Impact on Occupational Health and Safety

IMPACT	OCCUPATIONAL HEALTH AND SAFETY			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Within the Project area			
Impact Frequency	During operational phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Moderate.				

COMMUNICABLE DISEASES

Even though the required number of workers is limited during operation, there is potential for the spread of diseases among workers, or within the local community and vice-versa to the workforce.

Table 5-10 Summary of Pre-mitigated Impact on Communicable Diseases

IMPACT	COMMUNICABLE DISEASES			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent

IMPACT	COMMUNICABLE DISEASES			
Impact Extent	Local	Regional	International	
Impact Scale	Project Area and settlements around the Project			
Impact Frequency	During operational phase			
Impact Likelihood	Unlikely	Possible	Likely	
Impact Magnitude	Negligible	Small	Medium	Large
Impact Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major
Significance of impact is considered Minor .				

WORKING CONDITIONS

The number of staff required during operation is limited at approximately 150. 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 can impact the lives of Project workers

Table 5-11 Summary of Pre-mitigated Impact on Working Conditions

IMPACT	WORKING CONDITIONS			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Project area			
Impact Frequency	During operation phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small	Medium	Large
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor	Moderate	Major
Significance of impact is considered Moderate.				

GENDER BASED VIOLENCE AND HARASSMENT

Much of the staff will be direct employees of the Project Company, therefore the potential risks associated with violence and harassment are anticipated to be limited due to consistent processes in place as part of the respective HR management systems, assuming they are appropriately designed and resourced.

Table 5-12 Summary of Pre-mitigated Impact on GBVH

IMPACT	GBVH		
Impact Nature	Negative	Positive	Neutral
Impact Type	Direct	Indirect	Induced

IMPACT	GBVH			
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Project area			
Impact Frequency	During opeational phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Moderate.				

5.5 Mitigation Measures

5.5.1 Construction Phase

To reduce potential impacts on health and safety of the community and site personnel, and to ensure the provision of the required human rights during the construction phase, appropriate measures should be implemented. The table below presents the relevant mitigation measures.

Table 5-13 Human Rights Mitigation & Management Measures – Construction

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Public/Community Safety and Security	- Risks to public safety will be appropriately addressed and prepared for in an 'Emergency Preparedness and Response Plan'. - 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. - Site personnel should be trained in emergency procedures and plans, and the potentially affected receptors should be notified of procedures to follow via relevant communication channels. - Employees shall undergo a Code of Conduct (COC) training to ensure smooth coordination with the neighbouring community. - Project induction training will include a section on COC when engaging with local community members. This will include an overview of culturally appropriate measures and etiquette to bear in mind. - All high-risk areas 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. - The implementation of a robust grievance mechanism will be ensured. - The EPC Contractor shall prepare a Security Plan consistent with its Security Risk Assessment. - The Project will employ its security staff to provide 24/7 security control across the Project site and dedicated security staff at gatehouses. - All vehicles entering the site will require pre-approved clearance and will need to be registered. - The Project site will be guarded during the enabling work's stage and security will manage visitors as per the Security Management Plan. - 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. - People trying to gain unauthorised access to the site without appropriate permits and PPE will not be permitted or will be removed from site if identified, an investigation shall be carried out on how they were able to access the site, and corrective action taken. - The security personnel will be regularly trained on GBVH COC including how to handle grievances related to GBVH from the community.
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.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	- Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. - Provision of appropriate protective equipment to minimise risks, and the requirement and enforcement of its use. - Training of workers, and the provision of appropriate incentives for them to use and comply with OHS procedures and protective equipment. - Documentation and reporting of occupational accidents, diseases, and incidents. - Emergency prevention, preparedness, and response arrangements.
Staff/Community Exposure to Communicable Diseases	• Staff and workers shall have access to medical insurance, health 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 authorised medical centre doctors. Diagnosis includes identifying any new symptoms or any significant worsening of existing symptoms. • The potential for exposure to water-borne, water-based, vector-borne diseases and communicable diseases as a result of Project activities will be prevented, avoided, and minimised to the extent possible through following good hygienic practices. • Any external and internal spreading of diseases shall be diagnosed and the precautions as per the instructions from the national or local medical authority shall be implemented. • The Health and Safety Team on site should provide advice during training or inductions on exposure to diseases, including national and project requirements for any infectious disease that may be present. • Provide a 24hr emergency hotline. • Isolate/care for sick and potentially infected staff and workers. • Identify any vulnerable groups (i.e., those with pre-existing conditions) working in the Project site (for the EPC and sub-contractors) and take precautionary measures in accordance with the national and World Health Organization (WHO) guidelines. • Provide testing for staff as required at no cost to them. • Promote personal hygiene among the workers and provide training and posters to remind workers to wash their hands regularly, clean their work areas and equipment, sanitize properly, etc. • Ensure suitable distancing, proper ventilation, and hygiene within workers accommodation. • Coordinate and regulate transportation of workers and access to the site i.e., through reduced bus occupancy, and temperature and PPE checks etc. • Provide a flexible working regime for employees who may prefer to work from home due to health issues, childcare, home schooling, etc. without fear of victimisation.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Worker's Conditions, Welfare and Accommodation	- 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/soap for hand cleaning; - Rest areas (with air conditioning, chairs, and tables); and - 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.) - Provide accommodation that complies with the IFC & EBRD Workers Accommodation: Processes and Standards (2009).
Workers' Terms of Employment, Non-Discrimination and Equal Opportunities, Working Relationships	- Project parties will establish HR Policies and processes to ensure working conditions and terms of employment are compliant with the requirements of National Labour Law, IFC PS 2, and associated ILO conventions. - 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, 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). Note: 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' 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. This may include the pre-qualification of such agencies to ensure that they do not have policies or processes relating to charging workers recruitment/other fees. - HR policies and procedures will be adapted appropriately to the size of the workforce required for the Project. Policies and procedures must

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	be prepared to demonstrate consistency with the requirements of national legislation and IFC PS 2.
Child Labour	- Project parties will comply with all relevant national laws and 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' Wages, Benefits, Conditions of Work and Retrenchment	- 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 and include a COC on GBVH. - Wages, benefits, and conditions of work offered should be overall 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 non-discrimination 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- Key Supply Chain	- Project parties shall devise and implement applicable controls to ensure the measures herein are implemented by any sub-contractors and the requirements for workers conditions are included in the pre-qualifications criteria for selection of key contractors and suppliers. - 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.
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

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	existing arbitration procedures, or a substitute for grievance mechanisms provided through collective agreements. - The grievance mechanism should be used to monitor worker morale, understand how workers are affected and what their concerns are in relation to communicable diseases, and address pressing matters promptly. - The grievance mechanism shall be provided for confidential reporting and a support system for any workers reporting issues relating to GBVH. It will also allow for reporting through word of mouth for those who cannot write. - A grievance mechanism for community members will be provided to raise concerns or complaints. - Community members will be informed of the grievance mechanism through stakeholders' engagement, and it will be made easily accessible to them. - Complaints will be acknowledged, addressed, and closed out in a timely manner.
Gender Inequality and Discrimination	- The Project parties will ensure that there is no discrimination in any form against female applicants in recruitment processes and during employment. - In the events that female employees are present on the site, there will be appropriate and sufficient provisions and facilities (for example, dedicated washrooms and separate changing rooms) easily accessible in working areas. - Worker's grievance mechanism will be in place at all times and will be suitable to receive and address potentially sensitive grievances coming from female employees.
Gender-based Violence and Harassment	- The Project parties will conduct a GBVH risk assessment in consultation with relevant stakeholders including women leaders and those working with young adolescent girls and boys. This will also include the identification of potential interventions and risk mitigation measures. - Awareness training will be mandatory for all Project workers regarding the GBVH risks and the workers responsibilities and the legal consequences of being a perpetrator. - Information will be provided on how to report any cases of violence or harassment and the services that will be made available to offer support to any of the survivors. - Approach towards GBVH prevention, mitigation and response will be survivor centred and ensure confidentiality, dignity, and respect to them. - The Project staff will be trained on how to preserve the safety of the women, girls, and boys when interviewing them and collecting information about their experiences on GBVH. - The Project will provide essential services for survivors such as access to counselling services, support groups, legal support etc. at no cost to them. - All determined cases of GBVH will be referred to relevant legal entities in the Project area for further investigation and prosecution. - The Project grievance mechanism will be made available to project workers and community members and will ensure that survivors' information is confidential and kept anonymous. - All cases relating to GBVH shall be documented and closed.

5.5.2 Operational Phase

To reduce the impacts on health and safety of the community and site personnel, and to ensure the provision of the required human rights during the operational phase, appropriate measures should be implemented. The following table presents the relevant mitigation measures.

Table 5-14 Human Rights Mitigation & Management Measures – Operation

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Public/Community Safety	- Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and training. - The plan will include the appropriate procedure to respond to any such incidents, as well as site-specific contact details and details of external agencies who may be required. - All high-risk areas including fuel storage areas (such as at the Emergency Generator) will be secured. - Appropriate mechanisms for emergency control (e.g., firefighting equipment) will be placed at suitable positions around the site. - The employees during the operational phase shall undergo a COC training to ensure smooth coordination with any neighbouring community. - Grievance Redress Mechanism shall be made accessible to the community to ensure that community members raise grievances to the Project leadership.
Public/Community 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 security personnel will be regularly trained on GBVH COC including how to handle grievances related to GBVH from the community. - 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 KSA 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.
Occupational Health and Safety	The Project Company will provide the workers with a safe and healthy work environment, considering inherent risks and specific classes of hazards associated with the Project.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	- The Project Company shall implement and maintain an OHS management system considering specific risks associated with the Project, legal requirements, and duty of care. - The Project 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 requirement and enforcement of 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
Staff/Community Exposure to Communicable Diseases and Associated Risks	- Staff and workers shall have access to medical insurance, health 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 authorised medical centre doctors. Diagnosis includes identifying any new symptoms or any significant worsening of existing symptoms. - 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. - Any external and internal spreading diseases shall be diagnosed and the precautions as per the instructions from the national/local medical authority shall be implemented. - Provide a 24hr emergency hotline. - Isolate and/or care for sick and potentially infected staff and workers. - Identify any vulnerable groups (i.e., those with pre-existing conditions) working in the Project site and take precautionary measures in accordance with the national and WHO guidelines. - Provide testing for staff at no extra cost to them. - Promote personal hygiene among the workers and provide training, posters to remind workers to wash their hands regularly, clean their work areas and equipment, and sanitize properly etc. - The transportation of workers and access to the site shall be coordinated and regulated i.e., through reduced bus occupancy, temperature, and PPE checks etc. - Provide a flexible working regime for those workers who may prefer and are able to work from home due to health issues, childcare, home schooling etc. without fear of victimisation. - Address mental health issues during induction and provide information on how to seek help from local experts.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Worker Welfare (on 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).
Workers' 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. - 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). <i>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.</i>
Workers' 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 and include a COC on GBVH. - 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.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
Child Labour	- Project parties will comply with all relevant national laws and 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' 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 non-discrimination 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. - The workers/representatives shall be involved on any labour reduction measures.
Key Supply Chain (if any)	- Project Company shall devise and implement applicable controls to ensure the measures herein are implemented by any sub-contractors and are internally checked/audited. - Project Company shall 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.
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. - A grievance mechanism for community members will be provided to raise concerns or complaints.

POTENTIAL IMPACT	MITIGATION AND MANAGEMENT MEASURES
	- Community members will be informed of the grievance mechanism through stakeholders' engagement and make it easily accessible to them. - All complaints will be acknowledged, addressed, and closed out in a timely manner.
Violence and Harassment	- The Project parties will conduct a GBVH risk assessment in consultation with relevant stakeholders including women leaders and those working with young adolescent girls and boys. This will also include the identification of potential interventions and risk mitigation measures. - Awareness training will be mandatory for all Project workers regarding the GBVH risks and the workers responsibilities and the legal consequences of being a perpetrator. - Information will be provided on how to report any cases of violence or harassment and the services that will be made available to offer support to any of the survivors. - Approach towards GBVH prevention, mitigation and response will be survivor centred and ensure confidentiality, dignity, and respect to them. - The Project staff will be trained on how to preserve the safety of the women, girls, boys when interviewing them and collecting information about their experiences on GBVH. - The Project will provide essential services for survivors such as access to counselling services, support groups, legal support etc. at no cost to them. - All determined cases of GBVH will be referred to relevant legal entities in the Project area for further investigation and prosecution. - The Project grievance mechanism will be made available to project workers and community members and will ensure that survivors' information is confidential and kept anonymous. - All cases relating to GBVH shall be documented and closed.

5.6 Monitoring

The protection of human rights is an on-going process, and this should be reflected in the Project's internal management policies.

The EPC Contractor during construction, and the O&M Company during operations are expected to be the primary parties for ensuring that mitigation measures are internally audited, and processes are in place to protect labourers, subcontractors, suppliers, as well as the surrounding community. Monitoring required is provided in the table below.

Table 5-15 Key Monitoring Indicators during Construction and Operation

MONITORING	PARAMETER	FREQUENCY & DURATION	MONITORING LOCATIONS
Worker Contracts & HR	Records of contracts, payments, receipt of	On-going	For all Project workers (direct staff) and

MONITORING	PARAMETER	FREQUENCY & DURATION	MONITORING LOCATIONS
	benefits, leave entitlements, retrenchment etc.		oversight of sub-contractor staff dedicated to the project
Women employed in the Project	Number of women employed in the Project including their rank and remuneration compared to men occupying the same positions.	On-going	For all female Project personnel including those employed by the sub-contractors.
Worker Welfare	Quality, appropriate numbers and suitable locations of Sanitation Facilities, Office Spaces, Welfare and Rest Areas	On-going	At all such facilities on-site
Quality of Accommodation	Inspection/internal audit of worker accommodation facilities vs. IFC & EBRD standards	Monthly	All accommodation facilities provided to direct and full time sub-contracted labour.
OHS Near Misses (involving external parties)	Any classified near miss	On-going	n/a
OHS Emergency Situations and Incidents	Any classified emergency situation or incident	On-going	n/a
Grievances and disputes including those relating to gender-based violence and harassment, sexual exploitation & abuse, and sexual harassment	Grievances received	On-going	Project site and any other grievances received from communities in reference to Project workforce including suppliers.
Health of the workers	Records of the illnesses the workers are suffering from and an analysis of top diseases.	On-going	Project site clinic or first aid facility
Human rights complaints/violations as reported by Project workers including workers hired through third-parties or in the supply chain	Grievances received	On-going	As defined in the Stakeholder Engagement Plan (SEP)
Emergency Situations and Incidents	Any classified emergency situation or incident	On-going	n/a

6 CLIMATE CHANGE IMPACT ASSESSMENT

6.1 Overview

ACWA Power is seeking finance for the Project from international lenders who are understood to be signatories of the Equator Principles, hence are EPFIs, which necessitates compliance with the Equator Principles (EPs). This chapter has been prepared in compliance with the Equator Principles volume IV which requires the inclusion of a 'Climate Change Risk Assessment' (CCRA) as part of the ESIA studies for projects financed by EPFIs.

6.1.1 Objectives of the CCRA

The objectives of the CCRA are to:

- Review and outline the KSA national regulations and standards, and lenders requirements;
- Review the climate change context and trends of KSA, highlighting the main issues;
- Identify and describe the potential vulnerabilities of the Project to climatic risks;
- Identify and describe the potential impacts of the Project or its activities on the climate;
- Propose project alternatives for potential lesser climatic impacts; and
- Propose actionable recommendations and mitigations to reduce the risks of adverse impacts.

6.1.2 Scope of the CCRA

The CCRA focuses on the climatic risks and impacts to the Project, associated facilities, and workforce during the Construction and Operational phases of the Project.

It considers potential impacts of the Project on the climate also.

6.1.3 Methodology

To address the scope of the CCRA, the following methodology was followed:

- Data collection & baseline development;
 - Desktop background research of national regulations and standards
 - Collation of lenders' requirements for CCRA's
 - Desktop background research of climate risks in KSA, current climatic situations, and future trends
- Scoping of climate risks identified in lenders' requirements for relevance against national desktop background research information to identify potential hazards;

- Analysis of the Project specific level of risk of each identified national hazard;
- Outline of the potential Project alternatives; and
- Proposal of mitigation measures to limit the effects of these potential climatic hazards on the Project and methods of monitoring.

6.2 Standards and Regulations

6.2.1 National Context and Regulations

The Paris Agreement came into force on 4th November 2016. The KSA signed and ratified the Agreement on 3rd November 2016 (UNTC, 2023). To date, the Kingdom of Saudi Arabia has not released a national climate action plan, however, the country has established several initiatives to address climate change issues, including:

- Establishing a Renewable Energy Project Development Office (REPDO) by the Ministry of Energy in 2017 which outlined plans for the kingdom to develop 58.7GW of renewable energy capacity by 2030, in line with Saudi's Vision 2030. In 2019 they also increased the 2023 clean energy target almost threefold to 27.3GW, from the previous target of 9.5GW (MEED, 2019);
- Launched the Saudi Green Initiative (SGI) in 2021 which *"aims to combat climate change, improve quality of life and protect the planet for future generations"*, overseen by The Energy and Climate Change Committee and The Environment Committee (Saudi and Middle East Green Initiatives, 2022);
- Establishing a National Committee for the Clean Development Mechanism and Designated National Authority in 2009, which oversees the development process of Clean Development Mechanism projects;
- Establishing a Saudi Energy Efficiency Program launched by Saudi Energy Efficiency Centre, which aims at designing and implanting energy efficiency initiatives for the country; and
- Oil and Gas Climate Initiative lead by Saudi Aramco to help member companies support the Paris Agreement and its aims
 - (<https://oilandgasclimateinitiative.com/about-us/#guidingprinciples>).

6.2.2 Lenders Requirements

Equator Principles volume IV establishes that impacts on the 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, such as the recommendation by the Task Force on Climate-related Financial Disclosures (TCFD).

More specifically, Principle 1 states that factors such as climate change are required for the project categorisation based on the International Finance Corporation's (IFC) environmental and social categorisation process.

Principle 2 outlines the need for a climate change risk assessment, stating a requirement to "include assessments of potential adverse [...] climate change risks as part of the ESIA or other Assessment". It further states that "The Climate Change Risk Assessment should be aligned with the Climate Physical Risk and Climate Transition Risk categories of the TCFD". These are (TCFD, 2017):

- **Physical Risk:** Risks related to the physical impacts of climate change; and
 - Acute Physical Risk: those that are event-driven, including increased severity of extreme weather events, such as cyclones, hurricanes, or floods etc; and
 - Chronic Physical Risk: longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause sea level rise or chronic heat waves.
- **Transition Risk:** Risks related with a transition to a lower-carbon economy.

EP 2 delineates emissions into two scopes:

- **Scope 1 Emissions:** direct emissions from the project owned facilities, or facilities controlled within the physical project boundary; and
- **Scope 2 Emissions:** indirect emissions associated with the off-site production of energy used by the project, such as connection to the grid.

For projects with combined scope 1 & 2 GHG emissions of over 100,000 tonnes CO₂-eq per annum, Principle 2 states requirements for analysis of alternatives which evaluates low GHG intense alternatives, and Principle 10 states that projects should report their GHG emissions annually.

IFC's PSs underpin EP 2. PS 1 states that the clients "risks and impacts identification process will consider the emissions of greenhouse gases, the relevant risks associated with a changing climate and the adaptation opportunities, and potential transboundary effects."

PS 3 continues that clients should "consider alternatives and implement technically and financially feasible and cost-effective options to reduce Project-related GHG emissions during the design and operation of the Project". For projects producing in excess of 25,000 tonnes CO₂-eq per annum, PS3 states a requirement for the client to quantify scope 1 and 2 emissions.

6.3 Baseline Data

6.3.1 National Climate Change Context

The mean global temperature has increased by an estimated 1.09 °C since the pre-industrial era. Climate observation and analysis in recent decades indicate that the globe is warming

up at an average rate of 0.2°C per year (IPCC, 2021). Regarding long-term projections, the IPCC estimates a global mean surface temperature increase of 3.3 to 5.7°C in the period 2080-2100. The warming effect of progressive GHG emissions on the global climate has caused an upturn in the frequency and intensity of extreme weather events. Indirectly, these effects have also induced the occurrence of climate-sensitive natural disasters and hazards such as droughts, floods, sea-level rise, and landslides.

By the end of 2021, KSA was reported to have a population of 35.46 million people and Gross Domestic Product (GDP) totalling 833.5 billion US Dollars. While the oil and gas industry accounts for 50% of the country's GDP, the country's economy is also significantly reliant on climate sensitive sectors such as agriculture (OPEC, 2023).

For 2023, KSA scored a Climate Change Performance Index (CCPI) score of 22.41%, rating them as 'very low' and ranking 62nd of 63 countries evaluated (Germanwatch, 2023). KSA also scored a Climate Risk Index (CRI) index of 73, ranking 57th in terms of average fatalities, and 51st in terms of economic losses in relation to extreme weather events (Germanwatch, 2022).

With a growing urban population, increasing temperatures, dwindling groundwater resources, rising sea levels, and recurrent flood events, KSA is faced with growing biophysical and socioeconomic vulnerabilities to climate change. In response to the climate emergency, the country launched a coordinated move towards decarbonisation with its entry into the Paris Climate Accords in 2015, and they have also been part of the United Nations (UN) Framework Convention on Climate Change (UNFCCC) since 1994.

In a movement towards a greener environment, KSA launched the SGI in 2021 which "*aims to combat climate change, improve quality of life and protect the planet for future generations*". To date, it is reported (Arab News, 2023) that this initiative has led to:

- 150,000 homes powered by renewable energy;
- 18 million trees planted in 2022 in KSA;
- 62 sites approved for tree planting;
- 60,000 hectares of land rehabilitated in 2022;
- 250,000 cultivated shrubs in AIJLa nurseries;

6.3.2 National Climate

Standing amongst the world's hottest and most arid countries, Saudi Arabia is characterised by a desert climate. In terms of climatic zones defined by the Köppen climate classification system, most of the country falls within the hot, arid desert zone. There are remote patches of cold, arid steppe, and hot, arid steppe, and also areas of cold, arid desert climates, much of which represent mountainous pockets in the country's western reaches.



Figure 6-1 Köppen Geiger climate classification for Saudi Arabia

Source: Beck, H.E. et al. (2018)

The climate mostly consists of high daytime temperatures, inversely low night-time temperatures, and little, irregular precipitation. With climatological influences from both tropical and extra-tropical weather systems, the country experiences the four seasons of winter (December-February), spring (March-May), summer (June-August) and fall (September-November) (Odnoletkova and Patztek, 2021), with a wet season in March and April.

6.3.3 Natural Hazards

Climatic hazards can be divided into natural climatic hazards, and induced climatic hazards.

- **Natural Climatic Hazards** are those hazards that are directly related to the changing climate, such as temperature or rainfall. The climatic changes that are causing the hazards to occur are being directly caused by climate change.
- **Induced Climatic Hazards** are those that can be indirectly related to the changing climate, such as floods and forest fires. The hazards are being caused by other climatic changes, such as sea level rise being induced by increasing temperatures that are the result of climate change.

CLIMATIC NATURAL HAZARDS

Temperature

Baseline and Historic Trends

Summers in the central region are extremely hot and dry, ranging from 27°C to 43°C in the inland areas and 27°C to 38°C in coastal areas. In winter, the temperature ranges between 8°C to 20°C in the interior parts while higher temperatures of 19°C - 29°C have been recorded in the coastal areas of Red Sea (Climate Change Knowledge Portal, 2021). A graph illustrating the variation in mean annual temperature levels in the period 1991 to 2020 is shown below.

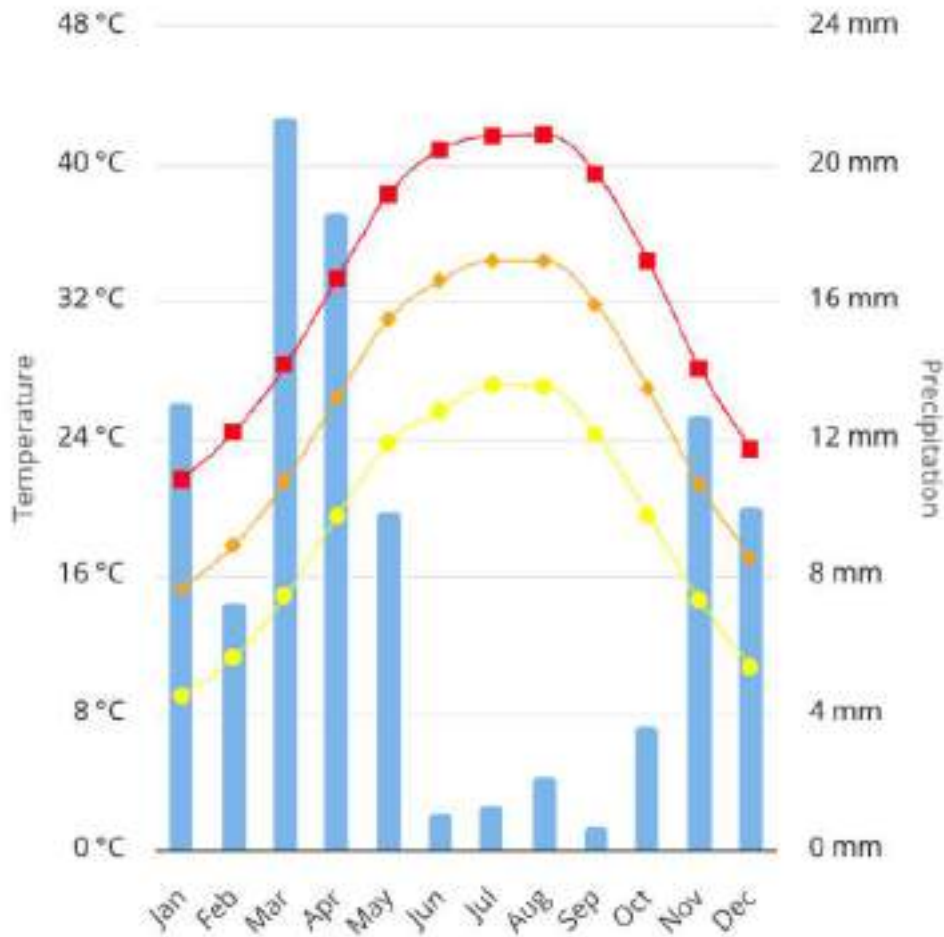


Figure 6-2 Observed Monthly Average Temperatures (Maximum – red; mean – orange, minimum – yellow), and rainfall (blue) in Saudi Arabia 1991-2020

Source: Climate Change Knowledge Portal (2021)

Projections

Below are projected temperatures for KSA using a range of Shared Socioeconomic Pathways (SSPs), future climate change scenarios based on broad socioeconomic trends that could shape future society. Modelling for the most severe SSP5-8.5 scenario predicts that maximum surface temperatures will rise by 16.8% from 2023 – 2100 to an average of 38.66 °C, and to at least 33.88 °C under SSP1-2.6.

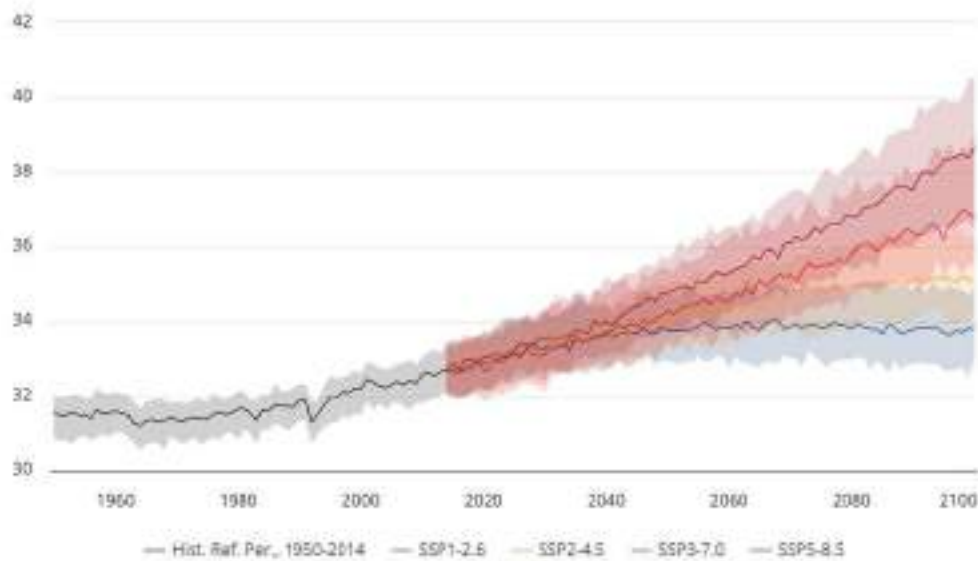


Figure 6-3 Projected Average Maximum Surface Air Temperature, Saudi Arabia

Source: Climate Change Knowledge Portal (2021)

Precipitation

Baseline and Historic Trends

KSA has a rainy season of March and April, as seen in Figure 6-2. The average annual rainfall in most parts of the country is below 150 mm throughout the year, except in the southwest part where the rainfall occurs between 400 – 600 mm annually (Climate Change Knowledge Portal, 2021). The annual average precipitation for 2010 – 2021 can be seen below, as well as monthly variations above in Figure 6-2.

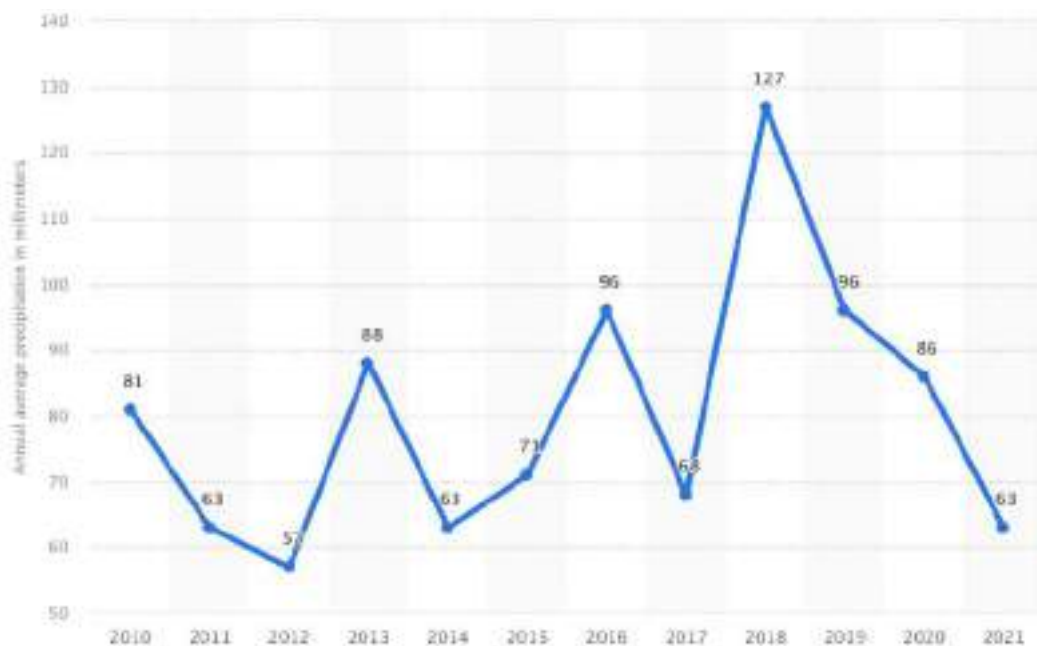


Figure 6-4 Annual Average Precipitation in KSA 2010 – 2021

Source: Statista (2023)

Projections

Using the SSP5-8.5 model, precipitation is estimated to rise by approximately 12 mm per annum, although there appears to be much variation in these estimations, as seen in the figure below.

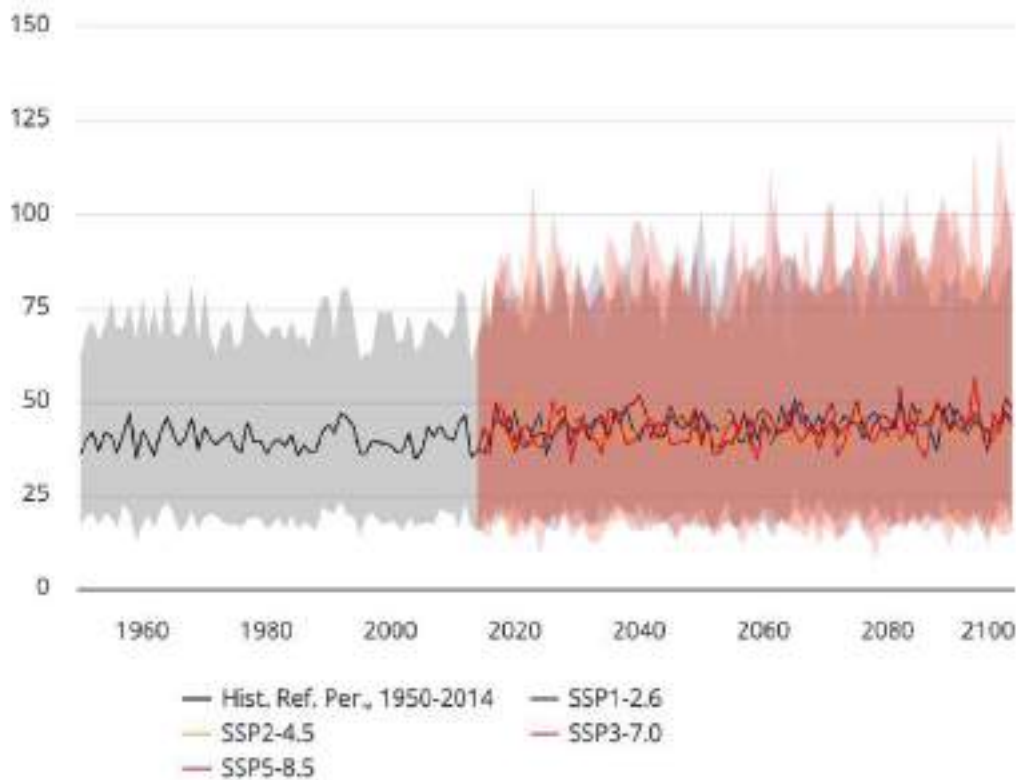


Figure 6-5 Project Precipitation in KSA

Source: Climate Change Knowledge Portal (2023)

The frequency of intense rainfall events is increasing for the majority of Saudi Arabia, while the frequency of weak events is decreasing. The contribution of extreme events (daily rainfall of ≥ 26 mm) to the total rainfall amount varies, but in one case was found to be up to 56%, and this is expected to increase, causing more large scale, intense rainfall events (Almazroui, 2020).

CLIMATE-INDUCED HAZARDS

Flooding

Flash floods are caused by slow-moving weather patterns (convective systems) that generate intense rainfall over a poorly drained area in a short space of time (less than six hours). As outlined above, KSA is observing a trend of more intense rainfall which leads to more extreme flooding.

Severe flash flooding events have been observed in Saudi Arabia in the recent years, especially in Western parts of the country. In August of 2023, the Mecca neighbourhood of Al-

Kakiyyah recorded 45 millimetres of rain within 24 hours, causing large scale flooding (Al Jazeera, 2023). A total of 11 extensive flash floods have occurred in KSA since 1985.

Floods are observed to be the most significant key natural hazard for the period of 1980 – 2020 in KSA.

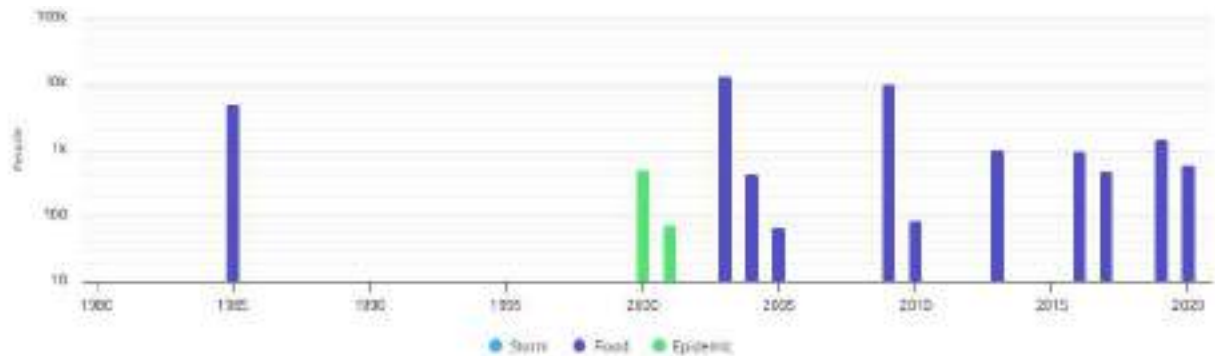


Figure 6-6 Number of People Affected by Key Natural Hazards in KSA 1980 – 2020

Source: Climate Change Knowledge Portal (2023).

Sea Level Rise

Sea level rise is a great national problem; however the Project site is more than 400 km from the nearest coastline and will be located at 978 m above sea level, therefore will not be affected by sea level rise.

Landslide

Think Hazard (2023) have classified the risk of landslides in KSA as 'Medium'. KSA's rainy season of March and April increases the risks of landslides throughout the country. Landslides are one of the biggest environmental risks to the northwest of KSA (Kahal et al., 2021), and are common in the west and southwest (Youssef et al., 2022).

Heat Waves and Drought

Over the past four decades, the mean annual temperature in Saudi Arabia has risen at a rate that is 50% higher than that of the remaining landmass of the Northern Hemisphere. KSA's mean temperature increased by 2.18°C between 1979 and 2019, which is threefold the global average. This trend has been paralleled by an increase in humidity.

The total duration of heat waves in a year (prolonged periods of maximum temperature records) is growing exponentially in most of the big cities in Saudi Arabia (Odnoletkova & Patzek, 2021). Such heatwaves are the most significant weather-related cause of mortality in the world (Gronlund et al., 2018).

The increase in temperatures will also cause an increase in distribution of vector organisms such as malarial mosquitoes, and therefore the transmission of numerous vector-borne diseases like malaria and dengue fever (McMichael et al. 2003).

Alongside heat waves, the rising temperatures are inducing more drought periods. KSA lies in a region of great water stress, and “is highly vulnerable to recurring droughts” (Syed et al., 2022). Eight drought years (1990, 2003, 2007, 2008, 2009, 2011, 2012 and 2017) are identified by Syed et al. (2022), the most extreme being 2007, and the longest period being from 2007 to 2012 when approximately 70% of KSA land area was under drought conditions (ibid.)

It is predicted that in KSA climate change will cause decreased regular national rainfall patterns and increased evaporation rates. More extensive dry periods are expected that will result in further depletion of groundwater reserves, and the worsening of water scarcity.

Water Scarcity

Water scarcity is a key challenge in KSA which depends heavily on desalinated water. According to the US - Saudi Business Council (2021), KSA is the largest country in the world without running surface water, but it has the third-highest per capita freshwater consumption in the world (2022), at over 8 million m³/day, forecast to reach 12.3 million m³/day by 2040.

As per the World Future Energy Summit, the Ministry of Environment, Water and Agriculture (MEWA) announced the launch of the Qatrah program in 2019 to rationalise water consumption and address the overuse and waste of water resources (WaterWorld, 2019). The mission of the program is to reduce 24% of the country's daily per capita consumption rate by 2022 and 43% by 2030.

Dust Storms

Dust storms refer to extensive dust dispersion events caused by strong winds that raise dust and sand from deserts and surrounding areas and carry it over large distances. KSA is situated on the Arabian Peninsula, the world's largest source of dust. Together with North Africa, these two regions account for 70% of global dust emissions (Ginoux et al., 2012). Most dust storms are found in the east of KSA, which experiences between 10 and 60 per annum (Albugami et al., 2019).

The increasing temperatures and prolonged dry periods can increase the severity or frequency of dusty days and hence the risk of dust storms. This may include increased wind velocity over current speeds.

Forest Fires

With warmer temperatures and drier climates, the risk of forest fires is increasing throughout KSA, particularly in the southern regions with more vegetation, where the risk is rated as ‘high’ by Think Hazard (2023).

Erosion and Desertification

It is believed that between 70 and 90 percent of the Arabian Peninsula is under threat of desertification. This desertification is leading to greater levels of erosion in KSA due to the dry, windy conditions, resulting in reduced land productivity and increased unwanted sedimentation.

6.4 Project Vulnerability

In line with EP 2 and IFC PS 1, this CCRA will assess the potentially adverse impacts of climate change risks to the Project, specifically. The potential impacts have been categorised according to the 'Climate Physical Risk and Climate Transition Risk' categories of the TCFD.

The acute and chronic climate-related hazards are defined following the major hazard groups as defined in EU Taxonomy⁴. The Equator Principles Guidance Note on Climate Change Risk Assessment⁵ states that these hazards should "*be taken into account as a minimum in the climate risk and vulnerability assessment*". These hazards have been scoped for national risk (See Appendix C) based to the desktop review of baseline data in Section 4.3, but not explicitly for the Project itself. The risks that are found to be relevant to KSA are assessed for Project relevance and vulnerability are discussed below. Additional risks to those from the EU Taxonomy have been added to the Project vulnerability assessment below based on the findings of the national baseline study.

6.4.1 Climate Physical Risk

ACUTE PHYSICAL RISK

Extreme Heat Events

The Project province of Riyadh is rated as high risk of extreme heat events (Think Hazard, 2023). If these events occur, Project workers' health and safety may be at risk, particularly if safety measures are not integrated for their protection when working outdoor in heat. The Project site is open, with no natural shade, so extreme heat events could have severe effects.

High temperatures also affect wind turbine performance, leading to energy loss and increased maintenance cost (Al-Khayat et al., 2021).

Extreme Precipitation Events

The Project is located inland in an area of the country that experiences relatively stable weather patterns. The province of Riyadh which the Project is located in receives moderate levels of rainfall at 120 mm average per annum between 1991 and 2020, and the most rainfall

⁴ https://finance.ec.europa.eu/system/files/2020-03/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en.pdf

⁵ https://equator-principles.com/app/uploads/Guidance-CCRA_May-2023.pdf

during March, with an average of 29.77 mm (Climate Change Knowledge Portal, 2021). Extreme precipitation events are not expected to affect the Project.

Drought and Water Scarcity

No water sources are available on site, hence all water will be provided from water source such as water trucks by local suppliers.

During construction, water will be used for construction activity purposes as well as for consumption. During operation, water will be mainly required for cleaning and consumption. Considering the above combined with the number of construction and operational workers, and from 5 Capitals' experience of working in KSA, drought and water scarcity impacts are not anticipated to pose a significant risk to the Project.

Flooding

The province of Riyadh which the Project is located in receives moderate levels of rainfall.

TYPSA conducted a hydrology assessment for the Project in March 2022. The Hydrology Assessment Report concludes that rain at the Project area is scarce and has a torrential nature. The site has large height differences and many ravines. Potential flooding areas have been taken into consideration during the design of the Project. Over the timescale of the Project, the changing climatic patterns will not significantly change the level of the risk to flooding, therefore the current low risks are accepted throughout the Project.

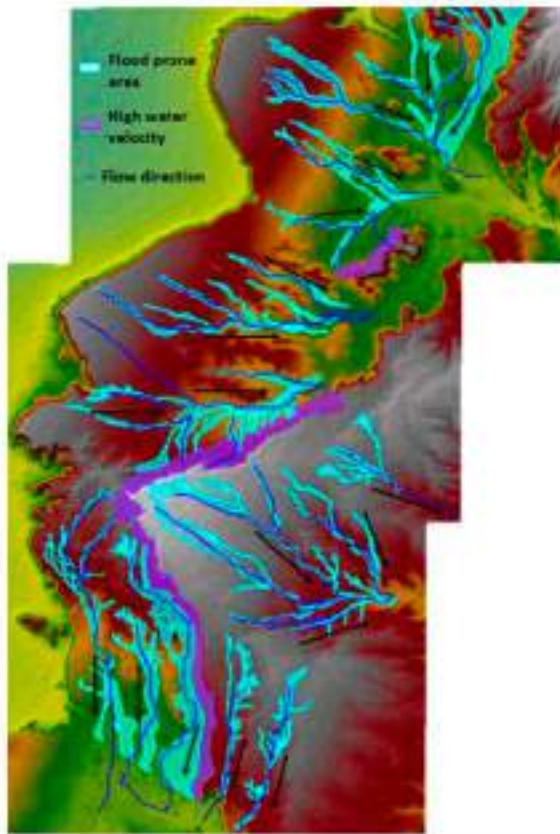


Figure 6-7 TYP SA Hydrological Map Showing Flood Prone Areas

Extreme Mass Movement

Although landslides and other mass movements have occurred within KSA, the Project site is flat and stable. Therefore, there is believed to be no overall risk of mass movement events at the Project site.

Dust and Sandstorms

In the event of warmer temperatures and any prolonged dry periods (i.e., during the summer), this could potentially result in the increase in the severity or frequency of dusty days, and dust or sandstorms. Severe dust or sandstorms can affect the workers' health if mitigation measures are not put into place.

Furthermore, dust accumulation on turbines also results in energy loss (Al-Khayat et al., 2021). The wind turbines will require more frequent cleaning, which also leads to increased water usage.

CHRONIC PHYSICAL RISK

Mean Temperature Change

Temperature rise is a national issue for KSA, suggesting that average temperatures could rise by as much as another 16% by 2100. The Project is expected to have 1,100 workers at the peak

construction period, the majority of which are expected will have to work outdoors. During the operational phase, it is expected there will be about 150 workers, some of which will also be working outdoors. Working outdoors in high temperatures for extended periods is dangerous to the health and wellbeing of the workers. It is expected that the number of these staff working outdoors will be limited where possible and the Project will incorporate resting periods during peak seasons.

The increase in temperature due to climate change will not be observed during the timescale of the Project, therefore the current risks are accepted throughout the Project.

Sea Level Rise

Sea level rise is a great national problem; however, the Project site located inland, thus will not be affected by sea level rise.

Erosion

The Project site has large height differences and many ravines. According to the Hydrology Assessment Report, intense, sporadic rainfall at the Project area can lead to erosion problems. It is also expected that every day winds will frequently move material around, off, or onto the Project site.

6.4.2 Climate Transitional Risk

As the Project is a wind project and is aligned with wider strategies for a transition to a lower carbon economy (such as those in line with Saudi Vision 2030), there are not expected to be any climate transitional risks related to future low carbon economies (policy, regulations etc.), or future public perceptions of the Project that are considered risks at this stage.

Table 6-1 Summary of Pre-mitigated Impact on Climate Risks

IMPACT	CLIMATE RISKS			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Within the Project area			
Impact Frequency	During construction and operational phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Minor.				

6.5 Project Effects

6.5.1 Construction Phase

SCOPE 1 GHG EMISSIONS

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 the EPC Contractor and sub-contractors administration and office areas.

Additionally, the construction phase of the Project will necessitate an amount of mobile equipment, vehicles, and machinery to facilitate works. Equipment such as excavators, rollers, cranes, pneumatic compressors, and other vehicles will be abundant on the site, and are expected to be used in most construction processes. Such equipment will be fuelled mostly by diesel.

It is estimated that approximately 233.3 KL of diesel will be required per month which equates to about 5600 KL of diesel for the entire construction period.

Using the GHG Protocol calculation tool for GHG Emissions from Stationary Combustion (World Resources Institute, 2015), the GHG emissions during construction were calculated in carbon dioxide equivalent (CO₂-eq) and are summarised in the table below.

Table 6-2 Generators-GHG Emissions During Construction of the Project

FUEL TYPE	VOLUME OF FUEL (L/MONTH)	GHG EMISSIONS (TONNES/MONTH)			TOTAL GHG (TONNES CO ₂ -EQ /MONTH) *
		CO ₂	CH ₄	N ₂ O	
Liquid Fossil (Diesel)	233,333	679	0.0275	0.027	687.27
Total GHG emissions from fossil fuels (tonnes CO₂-eq) per year					8,247.24
*if/when the generators are operational					

SCOPE 2 GHG EMISSION - GRID ELECTRICITY USAGE

Project will be grid connected during the construction phase. At this stage it is unclear on the timing of grid connection during the construction phase. Hence, it is challenging to estimate the potential electricity usage during the construction phase. Based on the geographic scale of the project, most of the construction work will be remote from the main temporary construction facilities. Therefore, the majority of power consumption in working areas will rely on the diesel generators for electricity and other diesel-powered construction plant/equipment.

Grid electricity usage (Scope 2 GHG emissions) is therefore likely to be less significant compared with Scope 1 GHG emissions.

6.5.2 Operational Phase

GHG ABATEMENT

As a renewable energy project, there is essentially a neutral operational impact on GHGs when the Project is generating, as the Project will not combust fossil fuels, other than for the potential running of generators for required operational functionality tests. A key benefit of the Project is the resulting lowering of the carbon intensity of the grid produced electricity in KSA.

It is possible to make a comparison of GHGs mitigated against a grid factor for GHG emissions in KSA. This is based on the KSA default grid factor of 569 gCO₂/KWh (Climate Scorecard, 2023).

It is expected that the Project will generate an average of 7,188,354 MWh per year for the entire 25-year operating period, generating an estimated relative net emissions saving of 4,090,173.4 tonnes of CO₂ equivalent per year (tCO_{2-eq} /year). Over this 25-year operating period this will result in an estimated total net saving of approximately 102.3 million tCO_{2-eq} when compared to conventional grid energy source.

SCOPE 1 GHG EMISSIONS

Due to the type of project and the Project's net power generation that will be consumed directly, there will not be a need for on-going fuel consumption (or other back-energisation from the grid) on a day-to-day basis.

The Project has emergency diesel generators that will be located on-site. These generators are not expected to be used except during grid blackout conditions where the generator would provide an amount of power load to enable the safe operation of the plant in such circumstances.

It is estimated that approximately 17,500 L of diesel fuel will be required annually. Using the Greenhouse Gas Protocol calculation tool for GHG Emissions from Stationary Combustion (Greenhouse Gas Protocol, 2015), the GHG emissions during operation were calculated and are summarised in the table below.

Table 6-3 Generator-GHG Emissions During Operation of the Project – Per Generator

FUEL TYPE	VOLUME OF FUEL (L/YEAR)	GHG EMISSIONS (TONNES/YEAR)			TOTAL GHG (TONNES CO _{2-EQ} /YEAR)
		CO ₂	CH ₄	N ₂ O	
Liquid Fossil (Diesel)	17,500	50.92	0.0021	0.002	51.55

SCOPE 2 GHG EMISSIONS - GRID ELECTRICITY USAGE

During typical operational conditions whilst the wind turbines are active and generating, the Project will consume internally generated power for the operations of its internal systems. This will ensure that systems are active such as those for meteorology monitoring, charging of

transformers and other administration systems. The exception would be during calm conditions where there is no on-going power generation from the WTGs and the Project will require to back-energise from the grid to operate these systems.

The annual electricity usage during the operation of the Project is estimated to be 5,000 MWh. According to Climate Scorecard, the energy sector in KSA generates 569 gCO₂/kWh. Therefore, a total of 2,845 tons of CO_{2-eq} are expected to be generated annually.

USE OF OZONE DEPLETING SUBSTANCES (ODS)

Sulphur hexafluoride (SF₆) is to be used in high voltage electrical equipment as the insulating gas, as part of the gas insulated switchgear. There may be some leakage from the gas insulated switchgear, or where mishandled. SF₆ switchgear is widely used in the electrical network and under normal operational conditions leakage should not occur. Management of ODS shall comply with the industry international good practices.

REFRIGERANTS

Trace amounts of refrigerants will be used in chiller packages where needed on-site for air conditioning, refrigerators etc. Where applicable, the requirements of the Montreal Protocol are applicable concerning the use and application of ODS. Any leakage of refrigerants would be negligible.

6.5.3 Decommissioning Phase

WASTE

Wind energy provides clean renewable energy without any emissions during operation. At the end-of-life stage, over 80% by weight of the above-ground components can be recycled, yet the blades, made with composite, are currently regarded as unrecyclable. By 2050, global annual blade waste will reach 2.9 Mt, with 43 Mt of cumulative blade waste (Liu and Barlow, 2017). No country-specific data is available for KSA, but with the country planning to reach 16 GW wind production by 2030 (Breakbulk Middle East, 2023), waste management and disposal for decommissioned turbine components will soon be required. Therefore, recycling of all turbine components, especially the blades, is imperative for a clean and sustainable environment.

The manufacturing of the wind turbine components is energy intensive and contributes to CO₂ emissions, representing 84.4% of the total energy requirement throughout the life cycle. However, the emission is insignificant compared to fossil fuel energy generation. The average energy payback time for a 2.0 MW turbine is found to be 7 months (Guezuraga et al., 2011).

Table 6-4 Summary of Pre-mitigated Impact on Climate-related Effects

IMPACT	CLIMATE-RELATED EFFECTS			
Impact Nature	Negative	Positive		Neutral
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	GHG Abatement			
Impact Frequency	During operational phase			
Impact Likelihood	Unlikely	Possible		Likely
Impact Magnitude	Negligible	Small		MediumLarge
Impact Sensitivity	Low	Medium		High
Impact Significance	Negligible	Minor		ModerateMajor
Significance of impact is considered Minor.				

6.6 Mitigation Measures

6.6.1 Resource Efficiency

The following measures can be implemented in subsequent stages of project planning to minimise GHG emissions over the course of the Project's lifetime:

The Project should implement comprehensive resource efficiency measures to reduce scope 1 and scope 2 GHG emissions during the Project's construction and operational phases. These measures generally include, but are not limited to the following:

- The procurement of equipment for the Project's construction and operational phases that give priority consideration to power efficiency, durability, and water conservation;
- During construction and operation, energy conservation measures for electricity-powered equipment should be promoted, and power consumption should be monitored. Economical use of fuel-powered equipment should be encouraged and monitored on the same basis; and
- During construction, resource efficiency in relation to construction materials should be promoted and monitored in the same manner.

6.6.2 Extreme Heat

The following mitigation measures shall be implemented to mitigate against heat-related medical conditions, for operational labour:

- Workers assigned to operations outside of the buildings and shaded areas will be provided with appropriate Personal Protective Equipment (PPE) (e.g., sun hats and cooling vests).

- Shaded resting areas (ideally with air conditioning) and adequate access to potable water will be provided for workers stationed outside of the Plant's buildings (e.g., guard houses).
- Work locations (and duration, to the extent possible) will be restricted during periods of extreme heat to lessen the risk of heat-related health effects. Maintenance work within high-temperature units will be avoided during days with inordinately high temperatures.
- Staff rooms on the plant's premises will be equipped with HVAC or fans to enable operations at workstations during periods of extreme heat.

6.6.3 Dust

To effectively manage dust-related issues in the context of climate change, it's recommended to maintain diligent visual and secondary monitoring (i.e., weather station reports or other publicly available sources) of dust levels, and ensure outdoor staff are not exposed to hazardous dust levels.

6.6.4 Water Availability

Although not identified as a significant risk to this Project, to reduce impacts on water resources, a water management plan/programme could be implemented to include the following:

- Installing smart water management systems (faucets with sensors, water meters, leakage detection systems etc.);
- Monitoring water consumption;
- Conducting regular maintenance of faucets, plumbing, water tanks etc.; and
- Raising awareness on water conservation among workers.

7 CUMULATIVE IMPACTS ASSESSMENT

Cumulative impacts are defined as those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. For any given project, a Cumulative Impact Assessment (CIA) serves to identify resultant environmental and social impacts that can synergize with equivalent impacts of proximate developments, and with natural stressors, such as climate change.

As such, the CIA process primarily consists of the following two aspects:

- Identification and characterisation of potential impacts that can be expected to ensue from the project activities, other developments, and environmental drivers within the temporal and special boundaries of the project in focus; and
- Development of actionable measures for effective prevention, mitigation, and alleviation of negative cumulative impacts and risks, and enhancement initiatives for any positive cumulative impacts.

7.1 Objectives of the Cumulative Impact Assessment

The objectives and outcomes of the CIA study for the Project are as follows:

- Identification of Project components, coincident developments, and natural/unplanned dynamics that bare mutual Environmental & Social (E&S) impacts, which may arise and/or intensify within the Project's lifetime and influence areas;
- Identification of Vulnerable Environmental Components (VECs) that are subject to E&S impacts brought on by the Project in synergy with external drivers;
- Overview of the current state of the VECs identified, with a focus on baseline attributes of particular relevance to the Project;
- A description and assessment of cumulative E&S impacts foreseen to affect established VECs, relative to baseline conditions, legal requirements, and internationally recognised benchmarks;
- Recommendation of effective mitigation measures to prevent, abate, and/or alleviate negative E&S impacts, alongside enhancement actions to reinforce anticipated Project benefits; and
- Development of a management and monitoring plan with a specific focus on the Project's E&S impacts, which should set out the timing, monitoring indicators, and responsible implementing parties for consistent impact management and performance evaluation in relation to established indicators and targets.

7.2 Identification of Concurrent Developments and Environmental Drivers

Existing structures and coincident developments that might have E&S impacts are listed below, it is understood the construction phases of this Project and the SEC substation and OHTL construction activities are concurrent.

Table 7-1 Activities and Developments Included in CIA

PROJECTS/ ENVIRONMENTAL STRESSORS	DESCRIPTION	STATUS
Existing overhead transmission line (OHTL)	An existing OHTL extends into the Project site.	Existing
SEC Sub-station (Associated Facilities)	The Project will be connected to adjacent SEC substation.	Under Construction
Overhead transmission line (OHTL) (Associated Facilities)	Overhead transmission line from the SEC sub-station.	Design Phase

7.3 Identification of Valued Environmental Components

The impacts on the main VECs that have been considered for the purpose of this CIA during construction and operation are:

- **Air Quality** – due to the arid nature of the site and surrounding areas there are potential cumulative air quality impacts (particularly with regards to particulate matter) should the construction phases of the projects overlap;
- **Noise** – concurrent construction activities have the potential to result in elevated noise levels across the wider area. Noise levels will be elevated because of construction activities and construction vehicles;
- **Ecology** – Cumulative land take resulting in habitat loss and fragmentation. Further, the erection and presence of numerous transmission lines has the potential to result in cumulative impacts to ecology, primarily avifauna, who are at risk of electrocution and collision with transmission lines;
- **Grazing Land** - Cumulative land take resulting in loss of grazing land;
- **Landscape/Visual Amenity** – Large scale cumulative impacts on landscape character from wind project components;
- **Waste Utilities** – Additional pressure on available waste services and utilities due to the large-scale construction projects;
- **Socio-economics** – Employment and other business benefits and opportunities; and
- **Traffic and Road Infrastructure** – Cumulative impacts during construction of multiple projects in the same area.

7.4 Assessment of Cumulative Impacts on VECs

Project activities set for the construction and operational phases were overlaid with respect to the biophysical and socioeconomic context within the Project area to identify interfaces and potential impacts that could grow in magnitude as a result of commonalities amongst the Project components and other local developments (identified above). Potential cumulative impacts derived from this analysis are itemised in correspondence to their respective VECs for the Project's construction and operational phases, in the following table.

Table 7-2 Assessment of Cumulative Impacts on VECs

VALUED ENVIRONMENTAL COMPONENTS	IMPACT-GENERATING PROJECTS	CUMULATIVE IMPACTS	
		CONSTRUCTION PHASE	OPERATIONAL PHASE
Air Quality	1. Starah 2000 MW Project (the Project – planned) 2. SEC Substation (under construction) 3. OHTL connection (planned)	• As a worst-case scenario it has been assumed that the construction periods of all the developments will coincide to an extent. • Local ambient air quality will be potentially affected by increased dust during site clearance and earthworks, as well as by gaseous emissions from the exhaust of construction vehicles, equipment, and temporary power generators. • With the adoption of typical and common management practices (mitigation measures) outlined in the ESIA Report, the cumulative impacts are anticipated to have only minor significance. This is mainly attributed to the remote location of the site, which has limited external sensitive receptors.	None expected.
Noise	1. Starah 2000 MW Project (the Project – planned) 2. SEC Substation (under construction) 3. OHTL connection (planned)	• As a worst-case scenario it has been assumed that the construction periods of all the developments will coincide to an extent. • Construction activities will result in temporary and short duration increases in the noise and vibration levels emanating from construction site noise and construction vehicle noise. With coinciding construction	None expected.

VALUED ENVIRONMENTAL COMPONENTS	IMPACT-GENERATING PROJECTS	CUMULATIVE IMPACTS	
		CONSTRUCTION PHASE	OPERATIONAL PHASE
		activities there is the potential for cumulative noise impacts. With the adoption of typical and common management practices (mitigation measures) outlined in the ESIA Report, the cumulative impacts are anticipated to have only minor significance. This is mainly attributed to the remote location of the site, which has limited external sensitive receptors.	
Ecology	- Starah 2000 MW Project (the Project – planned) - SEC Substation (under construction) - OHTL connection (planned) - Existing OHTL (Operation)	- Project land take will reduce the available land in the Project area. - Areas of gravel plain and sand that comprise much of the site would be largely unaffected as limited construction works will be required that affect the morphology and topography of such habitats.	The presence of transmission lines has the potential to result in cumulative impacts to ecology, primarily to avifauna which are at risk of collision and electrocution impacts.
Grazing Land	- Starah 2000 MW Project (the Project – planned) - SEC Substation (under construction)	- Project land take will reduce the available land in the Project area. - The quality of grazing vegetation within the Project site and locally is limited, and when the local herders were questioned, they stated that they almost exclusively feed their livestock with animal feed due to the lack of volume, species, and quality. Overall, the availability of land is ample, and the consultations with the local herders identified they have areas suitable that they can relocate to.	
Landscape/Visual Amenity	- Starah 2000 MW Project (the Project – planned) - SEC Substation (under construction)	Through construction, and sustained during operations, the land in the Project area will change from typical KSA desert landscape to one of a more industrialized character. The presence of wind turbines on the ridge will make a significant change to the visual amenity.	

VALUED ENVIRONMENTAL COMPONENTS	IMPACT-GENERATING PROJECTS	CUMULATIVE IMPACTS	
		CONSTRUCTION PHASE	OPERATIONAL PHASE
	3. OHTL connection (planned)	- There are certain identified local receptors such as the two nearby communities and nearby local road users that could be affected by visual amenity. - Lighting from the projects, although expected to be limited to certain areas (e.g., security entrances and control buildings) will likely be evident at distance, although this is not expected to result in light spill outside of the project areas. - The new OHTL and the erected wind turbines also present a vertical intrusion to a landscape that does not include this previously.	
Waste Utilities	1. Starah 2000 MW Project (the Project – planned) 2. SEC Substation (under construction) 3. OHTL connection (planned)	The construction phase of the project will likely overlap with the construction of the OHTL connection and SEC substation, which is located adjacent to the Project site. The generation of liquid, solid, and hazardous waste by the projects could potentially impose additional demands on the existing waste management facilities in the region.	None expected.
Socioeconomics	1. Starah 2000 MW Project (the Project – planned) 2. SEC Substation (under construction) 3. OHTL connection (planned)	- The outset and progress of construction on the Starah 2000 MW Project will create an influx of workers as most of the construction phase workers are expected to be foreign workers, likely from China. - In the absence of proper management, the influx of workers for the Project may potentially result in adverse impacts. These impacts are associated with the risk of social conflict due to different cultures, increased demand and pressure on public infrastructures, facilities and	- The main socio-economic advantage of the Project (including the substation and OHTL) is the benefit of grid stability for economic purposes. - The Projects will also create new employment opportunities (estimated 140 jobs) in the operations phase.

VALUED ENVIRONMENTAL COMPONENTS	IMPACT-GENERATING PROJECTS	CUMULATIVE IMPACTS	
		CONSTRUCTION PHASE	OPERATIONAL PHASE
		recourses, increased risk of communicable diseases or local inflation of prices.	
Traffic and Road Infrastructure	1. Starah 2000 MW Project (the Project – planned) 2. SEC Substation (under construction) 3. OHTL connection (planned)	• It is anticipated that there will be a period when construction activities for the projects will overlap, and shared routes may be used for transporting construction personnel, materials, and equipment. Given the collective magnitude of these construction operations, an increase in transportation activity can be expected. During periods of significant construction-related traffic, there is the potential for road congestion in specific areas or placing physical stress on the existing road infrastructure.	None expected.

8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Addendum Rationale: Further to the Stakeholder Engagement Plan that was included in the ESIA, this addendum has been prepared to address the gaps identified by the LTA to provide the structure and content of the ESMP, the mitigation and monitoring measures for the impacts assessed under this Addendum, the requirements for capacity building and training and emergency response plan.

8.1 Structure and Content of the ESMP

The key E&S management plans will be the CESMP and OESMP; respective to construction and operations. The CESMP and OESMP will comprise stand-alone documents structured to detail how environmental and social risks, impacts, opportunities and compliance will be managed and monitored. This shall be the top-level management plan document prepared by the EPC Contractor and O&M Company respectively.

The typical content of a CESMP/OESMP has been outlined below. This is not mandatory to be structured in this manner, but it is expected that the headings and sub-headings as a minimum are captured within the respective CESMP/OESMPs.

- Introduction
 - Background of Environmental Permitting
 - Objectives of the CESMP/OESMP
 - Scope of the CESMP/OESMP
 - Limitations
 - Structure of the CESMP/OESMP
- Project Description
 - Project Rationale and Background
 - Project Location
 - Land Use
 - Sensitive Receptors
 - Overview of Project Components
 - Overview of Associated Facilities
 - Overview of Construction/Operational Works and Workforce Requirements
 - Overview of Construction/Operational Facilities
 - Project Schedule (for CESMP)
- Regulatory Framework

- Overview of Regulatory Framework and Compliance Obligations
 - o Regional and International Treaties and Conventions
 - o KSA Legislation
 - o Lenders Requirements
 - o Environmental Standards
- Environmental and Social Management
 - Summary of Environmental and Social Management System (ESMS)
 - Reference to E&S Policies
 - o Applicable Project Company E&S Policy
 - o EPC Contractor/O&M Company E&S Policy
 - Statement of other supporting/complementary Plans and Procedures
 - Organisational Structure
 - o NCEC
 - o Lenders
 - o Project Company
 - o EPC Contractor/O&M Company
 - o Sub-contractors
 - HSE Roles and Responsibilities
 - Environmental Awareness and Training
 - o Environmental & Social Induction Training
 - o Toolbox Talk Environmental & Social Training Sessions
 - o CESMP/OESMP Training
 - Competency Needs and Records
 - Internal and External Communications
 - o Internal Communication
 - o External Communication
 - o Liaison with Regulator
 - Inspections and Audits
 - o Daily and Weekly Inspections
 - o Internal Audits
 - o Annual Internal Audits
 - o External Audits
 - Non-conformity, Corrections and Corrective Action
 - o Non-Conformity, Investigation and Response
 - o Incident Definition, Reporting, Investigation and Response
 - o Corrections and Corrective Actions
 - Control of Records
- Mitigation, Management and Monitoring
 - Air Quality
 - Climate Change

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- Noise & Vibration
 - Soil, Geology, Groundwater
 - Hydrology and Flood Risk
 - Terrestrial Ecology
 - Traffic & Transportation
 - Archaeological and Cultural Heritage
 - Landscape and Visual Amenity
 - Socio-Economic
 - Solid Waste & Wastewater Management
 - Community Health, Safety & Security
 - Labour & Working Conditions
 - Monitoring Summary
 - Emergency Preparedness and Response Overview
 - Appendices.

8.2 ESMP

The impact assessment and assessment of significance before and after mitigation follow the same methodology used by the original ESIA, and the ESMP table below only includes topics covered in this ESIA addendum. The ESMP for Land use and Socioeconomics, Human Rights, and Climate Change Impacts are summarised in the table below.

PROJECT STAGE/ AFFECTED ASPECT	POTENTIAL IMPACT	SIGNIFICANCE (PRE-MITIGATION)	MITIGATION MEASURES/ENHANCEMENT	RESIDUAL SIGNIFICANCE	IMPLEMENTATION	SUPERVISION	VERIFICATION / TIME/FREQUENCY	REPORTING REQUIREMENTS
Construction Phase								
Land Use and Socioeconomics	Land Use Change	Negligible	- No land users were encountered during the site visit. If there are land users, they are very likely to be nomadic herders who regularly move to different lands. The Project Company will offer its full support, as needed to assist the herders in case of any issues. - All the livestock owners and their workers will have access to the grievance mechanism.	Negligible	Project Company	Lenders/ NCEC	As necessary/ presence of herders on site	Grievance logs
	Relocation	Negligible	No structures or livestock was observed within the Project site. If there are, the owners of structures will be provided with support and sufficient time to identify and move to a suitable relocation site for their livestock.	Negligible	Project Company	Lenders/ NCEC	As necessary	Grievance logs

			- Monitoring will be undertaken to ensure that the herders have been able to successfully re-establish their activities at the new relocation site. - Should any issues arise with construction disrupting herders near the Project site, the concerned work will pause until a resolution is found.					
	Livelihoods	Negligible	All the livestock owners and their workers will have access to the grievance mechanism.	Negligible	Project Company	Lenders/ NCEC	As necessary	Grievance logs
	Access	Negligible	The Project will not obstruct any access routes outside of the Project boundaries.	Negligible	Project Company	Lenders/ NCEC	As necessary	Grievance logs
	Ecosystem Services	Negligible	- The Project activities will be restricted within its boundaries to ensure that there is no impact on areas outside its Area of Influence (Aoi). - The removal of vegetation and the cutting of trees will be avoided.	Negligible	Project Company	Lenders/ NCEC	As necessary	Grievance logs Conditions of vegetation
Human Rights	Public/ Community Safety	Minor	Risks to public safety will be appropriately addressed and prepared for in an 'Emergency Preparedness and Response Plan'. 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.	Negligible	EPC Contractor	Project Company / NCEC	During Construction	Records of trainings Grievance logs Incident logs

			- Site personnel should be trained in emergency procedures and plans, and the potentially affected receptors should be notified of procedures to follow via relevant communication channels. - Employees shall undergo a Code of Conduct (COC) training to ensure smooth coordination with the neighbouring community. - Project induction training will include a section on COC when engaging with local community members. This will include an overview of culturally appropriate measures and etiquette to bear in mind. - All high-risk areas 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. - The implementation of a robust grievance mechanism will be ensured.					Regular inspection and internal audits HSSE monthly reports
	Public/ Community Security	Minor	The EPC Contractor shall prepare a Security Plan consistent with its Security Risk Assessment.	Negligible	EPC Contractor	Project Company / NCEC	During Construction	Records of trainings

			• The Project will employ its security staff to provide 24/7 security control across the Project site and dedicated security staff at gatehouses. • All vehicles entering the site will require pre-approved clearance and will need to be registered. • The Project site will be guarded during the enabling work's stage and security will manage visitors as per the Security Management Plan. • 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. • People trying to gain unauthorised access to the site without appropriate permits and PPE will not be permitted or will be removed from site if identified, an investigation shall be carried out on how they were able to					Grievance logs Incident logs Regular inspection and internal audits HSSE monthly reports

			access the site, and corrective action taken. The security personnel will be regularly trained on GBVH COC including how to handle grievances related to GBVH from the community.					
	Occupational Health and Safety	Moderate	- 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	Minor	EPC Contractor	Project Company / NCEC	During Construction	Records of trainings Grievance logs Incident logs Regular inspection and internal audits HSSE monthly reports

			elimination of hazardous conditions or substances. • Provision of appropriate protective equipment to minimise risks, and the requirement and enforcement of its use. • Training of workers, and the provision of appropriate incentives for them to use and comply with OHS procedures and protective equipment. • Documentation and reporting of occupational accidents, diseases, and incidents. • Emergency prevention, preparedness, and response arrangements.					
	Communicable Diseases	Minor	• Staff and workers shall have access to medical insurance, health 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 authorised medical centre doctors. Diagnosis includes identifying any new symptoms or any significant worsening of existing symptoms. • The potential for exposure to water-borne, water-based, vector-borne diseases and communicable diseases as a result of Project activities will be prevented, avoided, and	Negligible	EPC Contractor	Project Company / NCEC	During Construction	Records of trainings Grievance logs Incident logs Regular inspection and internal audits

			minimised to the extent possible through following good hygienic practices. - Any external and internal spreading of diseases shall be diagnosed and the precautions as per the instructions from the national or local medical authority shall be implemented. - The Health and Safety Team on site should provide advice during training or inductions on exposure to diseases, including national and project requirements for any infectious disease that may be present. - Provide a 24hr emergency hotline. - Isolate/care for sick and potentially infected staff and workers. - Identify any vulnerable groups (i.e., those with pre-existing conditions) working in the Project site (for the EPC and sub-contractors) and take precautionary measures in accordance with the national and World Health Organization (WHO) guidelines. - Provide testing for staff as required at no cost to them. - Promote personal hygiene among the workers and provide training and posters to remind					HSSE monthly reports

			workers to wash their hands regularly, clean their work areas and equipment, sanitize properly, etc. • Ensure suitable distancing, proper ventilation, and hygiene within workers accommodation. • Coordinate and regulate transportation of workers and access to the site i.e., through reduced bus occupancy, and temperature and PPE checks etc. • Provide a flexible working regime for employees who may prefer to work from home due to health issues, childcare, home schooling, etc. without fear of victimisation.					
	Worker's Conditions, Welfare, and Accommodation On-Site	Moderate	• 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/soap for hand cleaning; • Rest areas (with air conditioning, chairs, and tables); and • Clean drinking water available in working areas (at a suitable temperature).	Minor	EPC Contractor	Project Company / NCEC	During Construction	Grievance logs Regular inspection and internal audits HSSE monthly reports

			• Provide accommodation that complies with the IFC & EBRD Workers Accommodation: Processes and Standards (2009). • If applicable, suitable and hygienic areas for eating and storing food (including refrigerators, heating devices [ovens/microwaves] etc.)					
	Workers' Terms of Employment, Non-Discrimination and Equal Opportunities, Working Relationships	Moderate	• Project parties will establish HR Policies and processes to ensure working conditions and terms of employment are compliant with the requirements of National Labour Law, IFC PS 2, and associated ILO conventions. • 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, 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,	Minor	EPC Contractor	Project Company / NCEC	During Construction	Grievance logs HSSE monthly reports

			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' Forced Labour	Moderate	- 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	Minor	EPC Contractor	Project Company / NCEC	During Construction	Grievance logs Regular inspection and internal audits HSSE monthly reports

			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. This may include the pre-qualification of such agencies to ensure that they do not have policies or processes relating to charging workers recruitment or other fees. 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.					
	Child Labour	Moderate	- Project parties will comply with all relevant national laws and 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.	Minor	EPC Contractor	Project Company / NCEC	During Construction	Grievance logs Regular inspection and internal audits HSSE monthly reports

			- 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' Wages, Benefits, Conditions of Work and Retrenchment	Moderate	- 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 and include a COC on GBVH. - Wages, benefits, and conditions of work offered should be overall comparable to those offered by equivalent employers in the relevant region of that country/region and sector concerned.	Minor	EPC Contractor	Project Company / NCEC	During Construction	Grievance logs Records of wages, benefits, contracts, and retrenchment HSSE monthly reports

			• 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 non-discrimination 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. • Project parties shall devise and implement applicable controls to ensure the measures herein are implemented by any sub-contractors and the requirements for workers conditions are included in the pre-qualifications criteria for selection of key contractors and suppliers. • 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.					
	Grievance Mechanism	N/A	- 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. - The grievance mechanism should be used to monitor worker morale, understand how workers are affected and what their concerns are in relation to communicable diseases, and address pressing matters promptly.	N/A	EPC Contractor	Project Company / NCEC	During Construction	Grievance logs HSSE monthly reports

			- The grievance mechanism shall be provided for confidential reporting and a support system for any workers reporting issues relating to GBVH. It will also allow for reporting through word of mouth for those who cannot write. - A grievance mechanism for community members will be provided to raise concerns or complaints. - Community members will be informed of the grievance mechanism through stakeholders' engagement, and it will be made easily accessible to them. - Complaints will be acknowledged, addressed, and closed out in a timely manner.					
	Gender Inequality and Discrimination	Moderate	- The Project parties will ensure that there is no discrimination in any form against female applicants in recruitment processes and during employment. - In the events that female employees are present on the site, there will be appropriate and sufficient provisions and facilities (for example, dedicated washrooms and separate changing rooms) easily accessible in working areas. - Worker's grievance mechanism will be in place at all times and	Minor	EPC Contractor	Project Company	During Construction	Records of trainings Grievance logs Regular inspection and internal audits

			will be suitable to receive and address potentially sensitive grievances coming from female employees.					HSSE monthly reports
	Violence and Harassment	Moderate	- The Project parties will conduct a GBVH risk assessment in consultation with relevant stakeholders including women leaders and those working with young adolescent girls and boys. This will also include the identification of potential interventions and risk mitigation measures. - Awareness training will be mandatory for all Project workers regarding the GBVH risks and the workers responsibilities and the legal consequences of being a perpetrator. - Information will be provided on how to report any cases of violence or harassment and the services that will be made available to offer support to any of the survivors. - Approach towards GBVH prevention, mitigation and response will be survivor centred and ensure confidentiality, dignity, and respect to them. - The Project staff will be trained on how to preserve the safety of the women, girls, and boys when interviewing them and collecting	Minor	EPC Contractor	Project Company	During Construction	Records of trainings Grievance logs Regular inspection and internal audits HSSE monthly reports

			information about their experiences on GBVH. - The Project will provide essential services for survivors such as access to counselling services, support groups, legal support etc. at no cost to them. - All determined cases of GBVH will be referred to relevant legal entities in the Project area for further investigation and prosecution. - The Project grievance mechanism will be made available to project workers and community members and will ensure that survivors' information is confidential and kept anonymous. - All cases relating to GBVH shall be documented and closed.					
Climate Change Effect and Risks	Construction GHG emissions	Minor	- The procurement of equipment for the Project will give priority consideration to power efficiency, durability, and water conservation; - During construction, energy conservation measures for electricity-powered equipment should be promoted, and power consumption should be monitored. Economical use of fuel-powered equipment should be encouraged and monitored on the same basis;	Negligible	EPC Contractor	Project Company / NCEC	During Construction	

			During construction, resource efficiency in relation to construction materials should be promoted and monitored in the same manner.					
	Extreme Heat	Minor	- Workers assigned to operations outside of the buildings and shaded areas will be provided with appropriate Personal Protective Equipment (PPE) (e.g., sun hats and cooling vests). - Shaded resting areas (ideally with air conditioning) and adequate access to potable water will be provided for workers stationed outside of the Plant's buildings (e.g., guard houses). - Work locations (and duration, to the extent possible) will be restricted during periods of extreme heat to lessen the risk of heat-related health effects. Maintenance work within high-temperature units will be avoided during days with inordinately high temperatures. - Staff rooms on the plant's premises will be equipped with HVAC or fans to enable operations at workstations during periods of extreme heat.	Negligible	EPC Contractor	Project Company / NCEC	During Construction	
	Dust	Minor	To effectively manage dust-related issues in the context of climate change, diligent visual and secondary monitoring (i.e.,	Negligible	EPC Contractor	Project Company / NCEC	During Construction	

			weather station reports or other publicly available sources) of dust levels will be performed, and arrangements will be made to ensure outdoor staff are not exposed to hazardous dust levels.					
	Water Availability	Minor	- Installing smart water management systems (faucets with sensors, water meters, leakage detection systems etc.); - Monitoring water consumption; - Conducting regular maintenance of faucets, plumbing, water tanks etc.; and - Raising awareness on water conservation among workers.	Negligible	EPC Contractor	Project Company / NCEC	During Construction	
Cumulative impacts	N/A	N/A	No specific mitigation measures for cumulative impacts.	N/A	N/A	N/A	N/A	N/A
Operational Phase								
Land Use and Socio-economics	Land Use Change	Negligible	The site will not be fenced, and the majority of the Project site remains accessible to the public during the operational phase.	Negligible	O&M Company	Lenders/ NCEC	During Operation	Grievance logs
	Public/Community Safety	Minor	- 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	Negligible	O&M Company	Lenders/ NCEC	During Operation	Records of trainings Grievance logs Incident logs

			details and details of external agencies who may be required. - All high-risk areas including fuel storage areas (such as at the Emergency Generator) will be secured. - Appropriate mechanisms for emergency control (e.g., firefighting equipment) will be placed at suitable positions around the site. - The employees during the operational phase shall undergo a COC training to ensure smooth coordination with any neighbouring community. Grievance Redress Mechanism shall be made accessible to the community to ensure that community members raise grievances to the Project leadership.					Regular inspection and internal audits
	Public/Community Security	Minor	- 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 security personnel will be regularly trained on GBVH COC including how to handle grievances related to GBVH from the community. - All vehicles entering the site will require pre-approved clearance and will need to be registered.	Negligible	O&M Company	Lenders/NCEC	During Operation	Records of trainings Grievance logs Incident logs Regular inspection and

			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 KSA 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.					internal audits
	Occupational Health and Safety	Moderate	• The Project 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 Project Company shall implement and maintain an OHS	Minor	O&M Company	Lenders/ NCEC	During Operation	Records of trainings Grievance logs

			management system considering specific risks associated with the Project, legal requirements, and duty of care. - The Project 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 requirement and enforcement of 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					Incident logs Regular inspection and internal audits

			accidents, diseases, and incidents. Emergency prevention, preparedness, and response arrangements					
	Communicable Diseases and Associated Risks	Minor	- Staff and workers shall have access to medical insurance, health 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 authorised medical centre doctors. Diagnosis includes identifying any new symptoms or any significant worsening of existing symptoms. - 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. - Any external and internal spreading diseases shall be diagnosed and the precautions as per the instructions from the national/local medical authority shall be implemented. - Provide a 24hr emergency hotline. - Isolate and/or care for sick and potentially infected staff and workers.	Negligible	O&M Company	Lenders/ NCEC	During Operation	Records of trainings Grievance logs Incident logs Regular inspection and internal audits

			- Identify any vulnerable groups (i.e., those with pre-existing conditions) working in the Project site and take precautionary measures in accordance with the national and WHO guidelines. - Provide testing for staff at no extra cost to them. - Promote personal hygiene among the workers and provide training, posters to remind workers to wash their hands regularly, clean their work areas and equipment, and sanitize properly etc. - The transportation of workers and access to the site shall be coordinated and regulated i.e., through reduced bus occupancy, temperature, and PPE checks etc. - Provide a flexible working regime for those workers who may prefer and are able to work from home due to health issues, childcare, home schooling etc. without fear of victimisation. Address mental health issues during induction and provide information on how to seek help from local experts.					
	Worker Welfare (on site)	Moderate	Project parties will ensure that welfare provisions are available on-site, including but not limited to:	Minor	O&M Company	Lenders/ NCEC	During Operation	Grievance logs

			- 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).					Regular inspection and internal audits
	Workers' Terms of Employment, Non-Discrimination and Equal Opportunities, Working Relationships	Moderate	• 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. • Employment relationships shall be on the principle of equal opportunity and fair treatment, and will not discriminate	Minor	O&M Company	Lenders/ NCEC	During Operation	Grievance logs

			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.					

	Workers' Forced Labour	Moderate	- 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 and include a COC on GBVH. 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.	Minor	O&M Company	Lenders/ NCEC	During Operation	Grievance logs Regular inspection and internal audits
	Child Labour	Moderate	Project parties will comply with all relevant national laws and provisions related to the employment of minors.	Minor	O&M Company	Lenders/ NCEC	During Operation	Grievance logs

			- 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.					Regular inspection and internal audits
	Workers' Wages, Benefits, Conditions of Work and Retrenchment	Moderate	- 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	Minor	O&M Company	Lenders/ NCEC	During Operation	Grievance logs Records of wages, benefits, contracts, and

			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 non-discrimination 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. • The workers/representatives shall be involved on any labour reduction measures. • Project Company shall devise and implement applicable controls to ensure the measures herein are implemented by any sub-contractors and are internally checked/audited. • Project Company shall take reasonable steps to inquire about the use of child labour and forced labour in their supply chains and try to exert influence					retrenchment

			where possible or identify other suppliers.					
	Grievance Mechanism	N/A	- 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. - A grievance mechanism for community members will be provided to raise concerns or complaints. - Community members will be informed of the grievance mechanism through stakeholders' engagement and make it easily accessible to them.	N/A	O&M Company	Lenders/ NCEC	During Operation	Grievance logs

			All complaints will be acknowledged, addressed, and closed out in a timely manner.					
	Violence and Harassment	Moderate	- The Project parties will conduct a GBVH risk assessment in consultation with relevant stakeholders including women leaders and those working with young adolescent girls and boys. This will also include the identification of potential interventions and risk mitigation measures. - Awareness training will be mandatory for all Project workers regarding the GBVH risks and the workers responsibilities and the legal consequences of being a perpetrator. - Information will be provided on how to report any cases of violence or harassment and the services that will be made available to offer support to any of the survivors. - Approach towards GBVH prevention, mitigation and response will be survivor centred and ensure confidentiality, dignity, and respect to them. - The Project staff will be trained on how to preserve the safety of the women, girls, boys when interviewing them and collecting	Minor	O&M Company	Lenders/ NCEC	During Operation	Records of trainings Grievance logs Regular inspection and internal audits

			information about their experiences on GBVH. - The Project will provide essential services for survivors such as access to counselling services, support groups, legal support etc. at no cost to them. - All determined cases of GBVH will be referred to relevant legal entities in the Project area for further investigation and prosecution. - The Project grievance mechanism will be made available to project workers and community members and will ensure that survivors' information is confidential and kept anonymous. All cases relating to GBVH shall be documented and closed.					
Climate Change Effect and Risks	Operation GHG Abatement	Minor	- During operation, energy conservation measures for electricity-powered equipment should be promoted, and power consumption should be monitored. Economical use of fuel-powered equipment should be encouraged and monitored on the same basis; - During operation, resource efficiency in relation to construction materials should be promoted and monitored in the same manner.	Minor	O&M Company	Lenders/ NCEC	During Operation	

	Extreme Heat	Minor	- Workers assigned to operations outside of the buildings and shaded areas will be provided with appropriate Personal Protective Equipment (PPE) (e.g., sun hats and cooling vests). - Shaded resting areas (ideally with air conditioning) and adequate access to potable water will be provided for workers stationed outside of the Plant's buildings (e.g., guard houses). - Work locations (and duration, to the extent possible) will be restricted during periods of extreme heat to lessen the risk of heat-related health effects. Maintenance work within high-temperature units will be avoided during days with inordinately high temperatures. - Staff rooms on the plant's premises will be equipped with HVAC or fans to enable operations at workstations during periods of extreme heat.	Negligible	O&M Company	Lenders/ NCEC	During Operation	
	Dust	Minor	To effectively manage dust-related issues in the context of climate change, diligent visual and secondary monitoring (i.e., weather station reports or other publicly available sources) of dust levels will be performed, and arrangements will be made to	Negligible	O&M Company	Lenders/ NCEC	During Operation	

			ensure outdoor staff are not exposed to hazardous dust levels.					
	Water Availability	Minor	- Installing smart water management systems (faucets with sensors, water meters, leakage detection systems etc.); - Monitoring water consumption; - Conducting regular maintenance of faucets, plumbing, water tanks etc.; and - Raising awareness on water conservation among workers.	Negligible	O&M Company	Lenders/ NCEC	During Operation	

8.3 Management Plans

Several separate and standalone management plans and procedures will be required to complement the requirements of the ESMP. The requirements for these plans are primarily from the gap analysis report and the ESIA discussed herein under the relevant environmental disciplines.

The following tables provides a summary of these separate management plans and procedures.

Table 7-1 Complementary Plans and Procedures

PLAN / PROCEDURE	PURPOSE
Air Quality Management Plan	Air quality management Plan will serve to specify monitoring and management action for air emissions generated during the construction phase. The plan may include the mitigation and management actions specified in the ESIA.
Dust management Plan	Dust management Plan will serve to specify monitoring and management action for dust generated during the construction phase. The plan may include the mitigation and management actions specified in the ESIA.
Traffic Management Plan	The Traffic Management Plan will entail details of the logistics map of project construction vehicles including delivery timings and specific measures to minimise disruptions, traffic congestions and fuel use risks to the public and project staff.
Water Management Plan	This plan will identify project specific water supply channels and procedures for the sustainable use and management of water resources used throughout the construction phase of the Project.
Waste and Wastewater Management Plan	The Waste and Wastewater Management Plan will identify site-specific requirements for waste management inclusive of waste containment, segregation, temporary storage, transport, and disposal channels for both hazardous and non-hazardous waste.
Hazardous Material Management Plan	The plan will identify locations for material storage, storage requirements (specifications of bunds and buildings/warehouses to ensure environmental and H&S protection, segregation requirements etc.) and handling procedures to minimise environmental and OH&S risks. The plan will also serve to outline the roles and responsibilities for the handling of materials.
Biodiversity Management Plan	The Biodiversity Management Plan will identify specific issues relating to biodiversity impacts and risks arising during the construction for the protection of biodiversity resource. The plan will evaluate areas that have been cleared for the project development and outline ways to minimise ecological impacts and post-construction land rehabilitation to return land as close as practical to the pre-construction condition.
Noise and Vibration Management Plan:	This plan will manage and reduce noise and vibration impacts on nearby communities and wildlife. It should describe baseline noise levels, identify primary noise sources such as construction equipment and turbine operations, and establish noise mitigation strategies such as limiting work hours or using quieter machinery. It should also include grievance mechanism and periodic monitoring to ensure compliance with noise standards.

PLAN / PROCEDURE	PURPOSE
Soil and Groundwater Management Plan	This plan protects soil and groundwater from contamination or degradation during project activities. It should assess risks such as fuel spills, soil erosion, and improper storage of hazardous materials. Measures for soil conservation, erosion control, proper storage of excavated material, and groundwater monitoring must be clearly outlined, along with actions to remediate contamination if it occurs.
Pest Control Plan	The pest control plan aims to prevent infestations that could result from construction activities, such as improper waste disposal or standing water. It should identify potential pest risks, describe preventive hygiene and sanitation measures, and define appropriate control actions using environmentally safe methods. The plan should include staff responsibilities, monitoring procedures, and guidelines for minimizing ecological harm while managing pests.
Emergency Preparedness and Response Plan	The Emergency Preparedness and Response Plan will outline the contingencies put in place for a variety of potential emergency situations relevant to the construction phase. The plan will identify site specific requirements for response to pollution incidents. To include the identification of high-risk areas on a plan and the location of spill kits (and contents of spill kits).
Erosion and Sediment Control Plan	Outlines measures to prevent soil erosion and control sediment runoff during construction and operation. It includes techniques such as stabilizing slopes, using sediment traps, and managing disturbed soils to protect land and water resources.
Stormwater Management Plan	This plan focuses on managing rainfall runoff to reduce flooding, erosion, and water pollution through proper drainage systems and infiltration methods.
Spill Prevention and Response Plan	The Spill Prevention and Response Plan is designed to avoid environmental contamination from hazardous materials like fuel and chemicals, providing protocols for safe storage, spill response actions, and emergency preparedness.
Stakeholder Engagement Plan (SEP)	The plan shall outline project stakeholders, identify communication protocols for engagement with stakeholders. The SEP will identify frequency of communication with stakeholders and will further keep record of workers grievance mechanism and provide a reference to a separate grievance mechanism.
Grievance Mechanism	The Stakeholder Grievance Mechanism shall identify the process for external parties to raise grievances regarding the project. The mechanism shall be easily accessible (including for any vulnerable groups), non-discriminatory and provide a transparent process to raise concerns or complaints, which may be issued in an anonymous nature. The mechanism shall specify the roles and responsibilities of internal staff about the grievance mechanism and the procedure for responding to received grievances, including the timeline for response, engagement mechanisms and recording of records.
Security Management Plan	A security plan will be developed based on the outcomes of a security risk assessment to ensure reasonably foreseeable security risks have appropriate management processes in place. The plan will further ensure the relevant personnel are trained in weapons handling, human rights and receipt of grievances.
Occupational Health & Safety Plan	The plan will identify the required controls for worker health and safety during the commissioning and operational phases. The occupational health and safety plan serves to
Human Resources Policy	Human resource policies and procedures will be adapted appropriate to the size of the workforce required for the Project.

PLAN / PROCEDURE	PURPOSE
Labor and Working Conditions Management Plan	This plan will provide set of actions for the recruitment of the workforce. The plan will detail the procedure for effective recruitment of local staff (where available), the positions that could be filled by unskilled, semi-skilled and skilled local workforce, mechanisms that will be in place to ensure there is non-discrimination of women in assessing recruitment procedures and the training to be provided for each job role. The plan will also specify how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws.
Local Employment and Procurement Procedure	This plan will clearly identify the Project commitment to purchasing goods and services (where practicable without compromising on the quality and standard requirements for the Project). It will also set expectations with regards to the extent goods and services can be purchased from the local market in order to benefit local businesses without potentially leading to higher prices for local consumers.
Workers Accommodation Plan	This plan will outline the process and standards for the accommodation to be utilised by the Project workforce. It will include accommodation areas directly managed by the Project or rented/shared to accommodate the Project workforce. Accommodation areas in use by sub-contractor companies/staff (where staff are dedicated for the Project) will also be included.
Environmental and Social Monitoring Plan	The Environmental and Social Monitoring Plan will serve to specify monitoring requirements for all ESIA parameters. The monitoring requirements to be outlined by the plan will outline the prescribed methods and frequency of monitoring, and the compliance criteria.
Supply Management Plan	The Supply Management Plan will serve to ensure that the procurement, transportation, storage, and use of materials and equipment are managed in an environmentally and socially responsible manner. The plan will include a procurement strategy, material sourcing, transportation and logistics strategies for the development of the plant.
Chance Finds Procedure	An archaeological 'Chance Find Procedure' will be developed prior to construction and the start of site earthworks and will include protocols and procedures to stop work and methods to preserve potential finds. The plan will outline reporting requirements as well as emergency contact details of the relevant personnel to contact in the event of uncovering archaeological artefacts.
Site Inspection and Audit Plan & Procedure	The plan will detail the methodology of inspections and audits to ensure applicable Environmental and Social requirements are included as criteria within the scope of the inspection/audit.
E&S Training Plan	The E&S Training Plan will detail the site-specific training requirements in line with project plans and method statements, together with the frequency of training for project workforce. This plan will serve to ensure that the project workforce is informed about site procedures in the event of emergencies.

8.4 Environmental Capacity Building, Training and Awareness

All Project staff must be fully competent to perform their tasks based on appropriate education, training or experience. To minimise potential impacts of the Project on the environment, all Project Company, EPC Contractor/O&M Company and sub-contractor staff will be adequately trained to understand and comply with the environmental requirements and commitments of the Project.

All site-based Project Company, EPC Contractor/O&M Company and sub-contractor staff will be required to undertake a site-specific Environmental Induction prior to commencing any works. The aim of the Environmental Induction is to raise awareness of environmental issues identified in the ESIA and the associated mitigation and management measures detailed within the CESMP/OESMP and to ensure all Project staff are informed of their responsibilities and duties.

Outside of the Environmental Induction, the level of training will vary depending on staff roles and responsibilities. Example training requirements are outlined in the table below. As part of the ESMS, a tailored Training Plan will be developed which include all training requirements. The CESMP/OESMP will provide further detail on the training requirements.

Table 7-2 Example Training Requirements

EXAMPLE TRAINING	PROJECT STAFF	CONTENT	TIMING
Environmental Induction (Site Induction)	All Project Staff and Visitors	• Site layout; • Safety procedures and use of PPE; • Environmental Policy; • Legal commitments and requirements; • Overview of the CESMP/OESMP including environmental aspects and impacts associated with construction activities; • Role and responsibilities of site environmental management; • Communication procedures; • Grievance mechanism; • Emergency Procedures and contacts; and • Incident reporting procedure.	Prior to involvement in any construction activities.
Environmental Induction for Supervisors	Site Supervisors/ HSE Managers/ Environmental Managers	• As per the above, in addition: - Importance of toolbox talks and how to conduct toolbox talks; - Management of training records and grievances.	Prior to involvement in any construction activities.
Spill and Emergency Response Training	All Project Staff	• Detailed training on the response and procedures in the event of a spill of emergency.	Prior involvement in any construction activities.
Toolbox Talks	All Project Staff	• Toolbox Talk environmental training sessions may be focused on the following subjects: - Dust control and dust mitigation; - Air quality emissions and control measures; - Hazardous materials management, handling and transportation; - Spill prevention and response for personnel involved in the storage of fuel and other hazardous materials. Including use of spill kits and refuelling. - Storage, handling and use of chemicals; - Ecologically significant fauna and mitigation measures; - Noise control and mitigation measures; - Traffic control and mitigation; - Chance Find Procedure; - Waste management; and - Emergency incident response.	Weekly – additional bulletins and alerts as required.

Records of training delivered by internal and external providers shall be maintained by the EPC Contractor/O&M Company. These records should include a training register which details the name and date of the training and list of all attendees.

8.5 Emergency Preparedness and Response Plan

The likelihood of an incident can be minimised by effective preparedness and planning of reasonably foreseeable emergency situations. Given the nature of the project, construction risk assessments and Method Statements will include consideration of the potential for environmental incidents.

The Executive Regulations for Preparedness and Response to Emergencies and Environmental Disasters specify the controls for preparing and implementing these plans. The project must commit to preparing and updating its own plan for preparedness and response to potential environmental emergencies and disasters. The NCEC may request that the plan be submitted for review based on the results of the environmental inspection, periodic follow-up, or classification of the activity as a sensitive facility.

The Project will prepare certain complimentary plans/procedures associated with potential emergency situations (such as the material handling and storage plan). Such complimentary plans will be outlined in the Framework Environmental and Social Management Plan (FESMP) that will be prepared as part of the ESIA. The plans will identify procedures for reasonably foreseeable emergency situations considering the following:

- The most appropriate method for responding to an emergency situation.
- Internal and external communication process (with stakeholders and responders).
- Action required to prevent or mitigate health and safety, community and environmental impacts.
- Mitigation and response actions to be taken for different types of emergency situations.
- The need for post-emergency evaluation to determine and implement corrective and preventative actions.
- Periodic testing/drills related to planned emergency response actions.
- Training of emergency response.
- A list of key personnel and aid agencies, including contact details (such as fire department, spillage clean-up services).
- Evacuations routes and assembly points.
- The possibility of the need for mutual assistance from neighbouring organisations/projects.

In addition, when the Project includes the use of chemicals, the following information should be included in the plan:

1. Cases that require the use of chemicals (amount and type of leak that requires its use).

2. Type and components of the required chemicals.
3. Storage sites (locations, nature of the sites, depths, environmentally sensitive areas, environmentally sensitive receptors, etc.).
4. The expected environmental impacts of its use and how to address those impacts.

The project shall implement the plan, controls and requirements set by NCEC, and provide qualified human resources, equipment and necessary devices that ensure readiness to implement the plan. To increase readiness to implement the plan, the Project Company can contract a service provider approved by the NCEC. The plan shall include programs for periodic maintenance of equipment, to respond to environmental emergencies and disasters. It is also necessary to commit to conducting an internal audit to assess the project preparedness - at least once a year - provided that the relevant reports are submitted to the NCEC within a period not exceeding 30 days from the completion of the audit.

The NCEC determines the reporting mechanisms. In the event of an environmental incident, regardless of its size or type, the EPC Contractor through the Project Company must inform the NCEC and relevant authorities.

9 STAKEHOLDER ENGAGEMENT PLAN

Addendum Rationale: Further to the Stakeholder Engagement Plan that was prepared in the ESIA, this addendum has been prepared to address the gaps identified by the LTA to provide an overview of the vulnerable groups, monitoring programs and public consultation and disclosure strategy.

9.1 Public Consultations and Identifying Vulnerable Groups

There are no regulatory processes relating to the ESIA permitting in KSA that require consultation with communities. National legal and cultural factors in KSA prevent open public meetings or other mass consultations and public participation activities. As such, detailed socio-economic surveys or public consultations were not carried out and are generally not permitted. Where informal consultations could occur, those stakeholders are often not keen to participate and/or may not wish to express opinions or personal views and information.

Stakeholder engagement that is carried out with the governmental entities, regulators, ministries or municipalities is usually led by the Project sponsors. In general, if stakeholder engagement is necessary with affected landowners where land acquisition is required, then this is carried out by the Project sponsors in coordination with the Ministry of Municipal and Rural Affairs in line with the national Law of Eminent Domain and Temporary Taking of Property (Royal Decree No. M/15, May 12, 2003) and its implementing regulation (Ministerial Resolution No. 54, November 23, 2015).

The site visit did not identify any land users, herders, or physical structures within the areas surveyed. In instances where herders may be present in such areas, they are typically nomadic or semi-nomadic, moving between locations depending on grazing availability and seasonal conditions. As a result, any potential interaction is expected to be minimal and transient and impact on livelihoods is considered unlikely.

During the site visit undertaken by 5 Capitals, a local resident (working at the on-going SEC Substation construction site) was informally consulted with regard to his knowledge on any use of the land at the site either by formal or informal land users. We note that the conversation was unstructured and more general about the Project and local area. The resident advised that locals tend not to use the land in the site area, particularly due to anxiety about stability of areas close to the cliff edges and related safety concerns. He was shown the map of the site area and to the best of his knowledge (both as a resident and someone undertaking contract work in this specific area) did not know, or otherwise had observed herding activity on-going at the site. He indicated that most herding activity locally was undertaken from the settlement of Al Ahmer (approximately 11km to the east of the northern section of the site) and occurred primarily in proximity of the existing OHTL due to the availability of an access track along this line. The 5 Capitals team observed that the land elevation along the existing OHTL line tended to be at lower elevation

(under the cliff edge) than the site land on top of the cliff itself and hence was also likely a reason for the herding activity to be limited to that area and not specifically at the site, which would pose challenges for access. It was also typically observed by the 5 Capitals team that the land at lower elevations tended to have more abundant vegetation. This is common in this region as the areas where rainfall runoff will flow/accumulate will be in lower areas and hence these areas are typically more abundant with vegetation, that can be grazed.

In the context of KSA, the identification of vulnerable groups through conventional social surveys poses cultural and regulatory challenges as it is not customary or socially acceptable to conduct household-level socio-economic surveys or engage individuals in discussions that involve sharing personal or financial information, particularly in rural or conservative communities. This is due to sensitivities around discussing one's livelihood or perceived vulnerability with external parties.

Had the team encountered herders during the site visit, basic engagement such as informal interviews or a simplified questionnaire would have been attempted to understand their patterns of movement and any potential use of the project area. However, proactively visiting nearby towns or communities to collect detailed social data is not feasible in KSA.

9.2 Monitoring and Reporting

9.2.1 Key Performance Indicators (KPIs)

The following Key Performance Indicators (KPIs) should be considered to evaluate the progress or successful implementation of the SEP.

Table 9-1 SEP KPIs for Monitoring and Evaluation

KPI No.	KPI	TARGETS	TARGET TIMEFRAME	MEANS OF VERIFICATION (MOV)	FREQUENCY	RESPONSIBILITY
1	Cumulative number of grievances related to local community health, safety, security, social and environmental issues, by topic ⁶	Decreasing over time	On-going throughout construction and operations	Grievance logs	Monthly (construction) Quarterly (operations)	Project Company
2	Fraction of cumulative grievances that are pending/unresolved	100% of lodged grievances are closed out within specified timelines	On-going throughout construction and operations	Grievance logs	Monthly (construction) Quarterly (operations)	Project Company
3	Average time for grievance resolution	Decreasing over time	Throughout construction	Grievance logs	Monthly (construction)	Project Company

⁶ This count will include both closed and pending grievances. The cumulative grievance count will be broken down by grievance topic, for due monitoring, reporting, and management.

KPI No.	KPI	TARGETS	TARGET TIMEFRAME	MEANS OF VERIFICATION (MOV)	FREQUENCY	RESPONSIBILITY
			and operation		Quarterly (operations)	
4	Number of grievances received and resolved in regard to Harassment and gender based violence (GBV)	Zero	Throughout construction and operation	Grievance logs	Monthly (construction) Quarterly (operations)	Project Company
5	Percentage of quarterly and annual SEP commitments implemented and reported to project lenders	100% of quarterly and annual SEP commitments implemented and reported to project lenders	Throughout construction and operation	Engagement records	Quarterly and annually (as appropriate)	Project Company

9.2.2 Reporting

Reporting on the progress of the SEP and grievance redress mechanism implementation will be internal and will be allocated time on a monthly basis during management meetings.

It is acknowledged that the lenders will be interested in the progress to implement the SEP and issues that may be raised by communities in grievances. Therefore, all applicable records will be made available to the lenders and their independent E&S advisors upon request.

9.3 Disclosure of E&S Documents

9.3.1 Requirements

NATIONAL REQUIREMENTS

Listed companies on the Saudi Tadawul stock exchange (like ACWA Power) are encouraged to follow these voluntary Tadawul Environmental, Social, and Governance (ESG) Disclosure Guidelines (2021). They recommend disclosures on various environmental aspects such as resource use, emissions, environmental management systems, and compliance with environmental regulations. While not mandatory, adhering to these guidelines can enhance transparency and attract ESG-focused investors.

LENDERS REQUIREMENTS

EPIV requires, 'The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of Human Rights and climate change risks and impacts when relevant'.

The OECD Common Approaches requires that the Project ESIA is disclosed 'at least 30 calendar days before a final commitment to grant official support'.

9.3.1.1 Disclosure Plan

The table below provides the E&S Documents public disclosure plan.

Table 9-2 ESIA Public Disclosure Timetable

ACTIVITY	STAKEHOLDERS	METHOD	TIMING AND FREQUENCY
Disclosure of E&S Documents	All identified stakeholders	Upon agreement with the lenders, the ESIA Report, ESIA Non-Technical Summary (NTS) and SEP will be disclosed online in the public domain at ACWA Power's website. Depending on the lenders, the documents may also be published on their websites. Stakeholders will have the opportunity to raise comments or request additional information during this disclosure period. The grievance mechanism will be available at this time.	Minimum 30-day disclosure period prior to a final commitment to grant official support by the ECAs
		Hard copies of the ESIA, NTS and SEP (including grievance mechanism) will be provided upon request to stakeholders that do not have access to internet.	Upon request

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APPENDIX A – STAKEHOLDER ENGAGEMENT GUIDELINE

KSA STAKEHOLDER ENGAGEMENT GUIDELINE FOR PROJECT COMPANY HSSE TEAM

STAKEHOLDER ENGAGEMENT - OVERVIEW

Stakeholder engagement can be described as the systematic method to understand and involve stakeholders and their concerns in project activities and decision-making processes. It identifies the appropriate approach to be used for consultation and information disclosure. Stakeholders include persons or groups that may be directly or indirectly affected by the project, as well as those that may have interest in the project and/or those that may influence the projects outcome either positively or negatively.

OVERARCHING REQUIREMENTS

In order to meet Equator Principles IV (Principle 5 & 6) and IFC Performance Standard (PS 1) requirements, the Project is required to conduct stakeholder engagement.

GUIDELINES

The table below provides a guideline on how the consultation process should be undertaken by the Project Company – HSSE Team.

It is recommended that bi-lateral meetings are arranged and held with identified stakeholders. This will avoid open public events/gatherings. It can be explained that the key purpose of the consultations are:

- To share an overview of project information,
- To seek feedback on the project itself.
- To gather specific information on targeted issues.
- To seek advice on any issues in the area (or at the land) that may be of concern or that may have been overlooked.
- To advise on the availability of a third-party grievance mechanism (and how to access it).

ELEMENT	GUIDELINE
Meeting/Consultation Agenda	
Project information	Advise the stakeholder on the following: • Overarching requirement and context of the project – (i.e. in line with REPDOs targets under Vision 2030, Saudi Green Initiative, other strategy etc). • The project parties (including ACWA Power, the PC, EPC, O&M, Sub-Contractors, other relevant 3rd parties). • Project location (include maps showing the geographic location of the site, total area and project boundaries) • Summary of project components/facilities • Details and location of associated facilities (where available), such as access roads, sub-stations and locations of these. Also advise who is responsible for these works.
General overview of the project Construction	• Nature and scale of construction works, any phasing that is planned. • Expected numbers of workforce during construction and operational phases. • Location of project construction facilities such as temporary construction laydown areas, accommodation facilities etc. • Timeline and schedule of construction works. • Any expectation on traffic/vehicle flows. • Any specific facilities that may only be necessary for construction (e.g. temporary access roads, batching plants etc.)
General overview of the project Operation	• General overview of day-to-day operations (such as SCADA operations, typical maintenance, cleaning etc.) • Number of O&M staff
Project Impacts	<u>Positive Impacts</u> • Example of positive impacts include employment opportunities, diversification of existing skill base, contribution to KSA renewable energy targets, and reduction on reliance on fossil fuels, benefits towards KSA international targets and commitments linked to the Paris Climate Agreement. etc. <u>Negative Impacts</u> • Example of negative impacts include i.e., dust, noise & traffic during construction, landscape change, community health & safety risks etc. • To include a summary of key mitigation and management measures the project will put in place in order to minimise the negative impacts i.e., Note: the positive & negative impacts should match those identified in the ESIA and ESIA Addendum.
Discussions	During the consultations, stakeholders will be given time to ask for clarifications, additional project information or raise their concerns, or give their general feedback. Where available any requested information should be provided immediately, or where not possible the PC shall revert to them at a later agreed time.
Targeted Questions and Information Gathering	
Guidance Note: For this important part of the consultation process, please refer to the specific questions in the Annex.	
Grievance Mechanism	

ELEMENT	GUIDELINE	
Implementation of the Grievance Mechanism	An important part of the engagement process is to advise that there is a third-party grievance mechanism in place and how it can be accessed. The Project specific Stakeholder Engagement Plan (SEP) should include details of the grievance mechanism for the Project. In order to implement it, please ensure that the SEP is completed by including the following details:	
	COMPANY	DETAILS
	ACWA Power or Project Company Osamah Alkobraish	Email: oalkobraish@acwapower.co Work: XX Mob: XX
	EPC Contractor Gao Sa	Email: sgao3335@ceec.net.cn Work: XX Mob: XX
	The grievance mechanism will need to be publicised and available at the project entrance, Project website (if any) & during the consultation meetings. It is suggested that a handout on this is provided to the stakeholders so there is firmer evidence that this has been communicated.	
Grievance Mechanism	Advise the stakeholders that the purpose of the grievance mechanism is to evaluate and address stakeholders' problems and concerns regarding project activities and impacts. During the stakeholder consultation process, the participants will be made aware of the following: • That the grievance mechanism is available to all third parties (with a separate process for all staff to also raise grievances). • How to access the grievance mechanism (i.e., name of project personnel in charge, contact details including email, phone, office location (if applicable)) • Where stakeholders can file their complaints in person or anonymously (through a suggestion box outside the project entrance) • What type of response the complainants can expect to receive. • Duration of time it will take to receive a response (this should be aligned with the SEP).	
Record of Meetings/Consultations		
Minutes of Meetings	• Please document the proceedings of all meetings held with the different stakeholders and provide a list of participants including a signed attendance sheet where it is possible. • All feedback, queries (and the responses provided to these) must be documented. • Consultations through the phone, telecommunication channels such as Zoom, Microsoft Teams or messaging apps should also be documented. • A summary of informal consultations and general /side discussions should also be documented (in the event that formal meetings cannot be arranged).	
Photographs	If permitted by the stakeholder, timestamped photographs of the meeting should be taken – as evidence of the consultation undertaken.	

TARGETED CONSULTATION QUESTIONS

ID	QUESTION
Targeted Stakeholder Group	Herders and community leaders
1.	Have you used the land at the Project site in the past and what purpose did you use the land for? (Grazing, camping, transportation route, watermelon cultivation etc.)
2.	Do you obtain any services from the Project site (such as firewood, water, crops, or any cultural or spiritual benefits?)
3.	How long did you/the community use the project site?
4.	Was the land at the project site used seasonal or all year round? If it was seasonal, which months was the land used?
5.	Did you have any formal or informal agreement/contract to access or use the project site? If so, who was this agreement with?
6.	If the land was grazed, what type of herds and approximately how many livestock did you graze on the project site? - Camels - Goats - Sheep - Other etc
7.	Do you own the livestock or are you employed to graze them? If owned, do you employ any workers to assist you and are they on a formal working contracts?
8.	If the person is employed to graze the herds, please specify - Who owns the livestock you graze? - How much do you receive for grazing cattle? - Do you have an agreement with your employer?
9.	How and when were you notified about the project development and that you could no longer use the site?
10.	Who informed you?
11.	Do you have access to alternative land for grazing in the area close to your communities?
12.	Did you own any camps/structures on the project site? If yes, were you able to relocate them to a new site?
13.	Who owns this land and what are the terms of use (formal or informal agreements)?
14.	Were you provided with any support to move from the project site? If yes, what type of support was provided?
15.	What is your main source of income?
16.	What has the impact been on your livelihood as a result of relocating from the project site?
17.	What are your perceived impacts of the project?

APPENDIX B – CLIMATE CHANGE RISK SCREENING

CATEGORY		HAZARD	APPLICABILITY TO THE PROJECT	REASONS
Acute	Temperature Related	Extreme Heat Event	Applicable	- Extreme heat events found to be common in KSA. - ThinkHazard (2023) classes KSA at high risk of extreme heat.
	Water Related	Extreme Precipitation Events	Not Applicable	- Extreme precipitation events are not common within KSA. - Future projections vary in the possibilities of the worsening or bettering of these events, but changes are seen to be limited.
		Drought	Applicable	- Droughts are very common within KSA. - Droughts are causing greater water scarcity in KSA, which could affect the project and its workers.
		Flood	Applicable	- Floods are seen to be very common within KSA from the baseline study. - Coastal flooding is classed as high risk by Think Hazard (2023).
	Wind Related	Extreme Wind Events	Not Applicable	The baseline study found no evidence of extreme wind events that occur regularly, or any evidence of future trends to suggest this might occur.
	Solid Mass Related	Extreme Mass Movement	Applicable	- Landslides have occurred within KSA. - ThinkHazard (2023) classes KSA at moderate risk of landslides.
	Wildfires	Change In Fire Condition	Applicable	- Saudi Arabia has launched a project aimed at preventing forest fires in the kingdom's southern and southwestern regions. - ThinkHazard (2023) classes KSA at high risk of wildfires.
Chronic	Temperature Related	Mean Temperature Change	Applicable	Temperatures are currently very high throughout KSA, and the projections suggest this could rise by as much as another 16% by 2100.
	Water Related	Mean Precipitation Change	Not Applicable	Projections for KSA show no signs of the changes in precipitation levels.
		Sea Level Rise	Applicable	Think Hazard (2023) classifies KSA as at high risk to coastal flooding.

CATEGORY		HAZARD	APPLICABILITY TO THE PROJECT	REASONS
				Baseline desk study suggests that areas in KSA are at risk of sea level rise.
	Wind Related	Mean Wind Change	Not Applicable	Not significant trends in wind speed changes were found during the baseline study.
	Solid Mass Related	Erosion	Applicable	- Coastal erosion was found to be an issue in KSA during the baseline study. - Desertification is also leading to greater inland erosion.

APPENDIX C – ENVIRONMENTAL STANDARDS

The applicable environmental standards for the Project as per the national regulations and lender guidelines are outlined below. Where there is contradiction in limits between Saudi standards and lender guidelines, the most stringent will apply.

In accordance with lender requirements, where specific national standards do not exist, a best practice standard should be applied.

Air Quality

A. National Requirements

Ambient Air Quality Standards

The table below presents the national ambient air quality standards (MEWA, 2020) as per the Executive Regulations for Air Quality of the Environmental Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH.

Table A-1 KSA Ambient Air Quality Standards ($\mu\text{g}/\text{m}^3$ unless otherwise specified)

POLLUTANT	AVERAGE PERIOD	EXECUTIVE REGULATIONS (2020)*	
		STANDARDS	PERMITTED ALLOWANCES
Sulphur Dioxide (SO_2)	1 Hour	441	24 times per annum
	24 Hours	217	3 times per annum
	Annual	65	-
Nitrogen Dioxide (NO_2)	1 Hour	200	24 times per annum
	Annual	100	-
Carbon Monoxide (CO)	1 Hour	40,000	Once per annum
	8 Hours	10,000	Twice per annum
Ozone (O_3)**	8 Hours	157	25 days per annum, average calculated over 3 years
Suspended Particulate Matter ($<10\mu\text{m}$) PM_{10}	24 Hours	340	12 times per annum ***
	Annual	50	-
Suspended Particulate Matter ($<2.5\mu\text{m}$) $\text{PM}_{2.5}$	24 Hours	35	12 times per annum ***
	Annual	15	-
Lead (in suspended particulate Pb) (in TSP)	3 Months	0.15	Average is over 3 months

Notes:

* The values are at a standard temperature of 25°C and atmosphere pressure of 1atm.

** To calculate the ozone (O_3) value for 8 hours and to allocate it to the appropriate day, the following rule shall be applied: The maximum daily concentration of eight hours must be determined by examining the eight-hour operating averages, and it shall be calculated from

the data every hour and updated every hour. Each calculated eight-hour average is assigned to the day it ends with. That is, the initial calculation period for any day will be from 5 pm on the previous day to 1 am of the day; the last calculation period for any day is from 4 pm to 12 am.

*** Exceedances calculation: Contributions from natural sources can be assessed through measurements, modelling and remote sensing, then subtract these contributions from the air quality monitoring results. This is how the exceedances are calculated.

The table below provides the applicable standards for air emissions from 'stationary sources'.

Table A-2 Emission Limit Values for Emissions to Air from Stationary Sources

SOURCE	POLLUTANT	MAXIMUM VALUES FOR EMISSIONS
All emissions sources	PM	Opacity level shall not exceed 20% over the normal levels
Stockpiles	PM	Opacity level shall now exceed 10% over the normal levels

B. Lenders Requirements

As per IFC requirements (and as outlined in the OECD Common Approaches) the WBG EHS Guidelines are applicable for ambient air quality.

Ambient Air Quality

The WHO ambient air quality standards are adopted by the WBG General EHS Guidelines and are presented in the table below.

Table A-5 WHO Ambient Air Quality Standards ($\mu\text{g}/\text{m}^3$ unless otherwise specified)

PARAMETER	24 HOUR	ANNUAL
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 (Interim target 4)	20 (Interim target 4)
	45 (guideline)	15 (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 (Interim target 4)	10 (Interim target 4)
	15 (guideline)	5 (guideline)
NO ₂	120 (Interim target 1)	40 (Interim target 1)
	50 (Interim target 2)	30 (Interim target 2)
	25 (guideline)	20 (Interim target 3)
		10 (guideline)
SO ₂	125 (Interim target 1)	500 (10-minute guideline)
	50 (Interim target 2)	
	40 (guideline)	

PARAMETER	24 HOUR	ANNUAL
O ₃	100 (interim target 1) (8-hour daily maximum)	
	70 (interim target 2) (8-hour daily maximum)	
	60 (8 hour daily maximum guideline)	

Source: WHO Global Air Quality Guidelines, 2021

For new power plants, as per the IFC EHS Guidelines for Thermal Power Plants (2008), emissions from a single project should not contribute to more than 25% of the ambient air quality standards.

Noise & Vibration

A. National Requirements

The KSA standards in the tables below have been referenced from the Executive Regulation for Noise of the Environment Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH, these standards relate to the following:

- Residential and commercial areas (Ambient Noise Standards);
- Roadsides;
- Industrial areas; and
- Construction sites.

The noise standards applied to residential and commercial areas are according to the following classifications:

- Class A: Low-density residential areas as well as attractions and theme parks, areas around hospitals, schools, nursing homes, nurseries and environmentally sensitive areas.
- Class B: Medium-density residential areas.
- Class C: High-density residential areas and areas that include a mix of residential and commercial activities.
- Class D: Commercial areas, including warehouses and financial centres.

It is prohibited to exceed the noise levels standards for residential and commercial areas shown below, except with a permit from NCEC. It should be noted that these standards are applied at the closest receptor location.

Table A-6 Noise Standards for Residential and Commercial Areas

CLASS	DAYTIME L _A EQ, T (dB)	NIGHT L _A EQ, T (dB)
A – Low-Density Residential Areas	50	40
B – Medium-Density Residential Areas	55	45
C – High Density Residential Areas	60	50

CLASS	DAYTIME L _{Aeq} , T (dB)	NIGHT L _{Aeq} , T (dB)
D - Commercial Area	65	55

The table below presents the noise limits for roadsides.

Table A-7 Noise Standard for Roadside

DAYTIME L _{Aeq} , T (dB)	NIGHT L _{Aeq} , T (dB)
70	65

The table below presents the noise limits are industrial areas (at the outer boundaries of activities).

Table A-8 Noise Standards for Industrial Area

DAYTIME L _{Aeq} , T (dB)	NIGHT L _{Aeq} , T (dB)
70	65

The noise limits for construction sites are presented in the table below.

According to Article 7 of MEWA Executive Regulation for Noise, the noise limits outlined in the table above can be exceeded while carrying out construction works from 7am to 6pm. The exceedance shall be in accordance with the corrective limits presented in the table below.

Table A-9 Corrective Limits of Permissible Noise Levels at Construction Sites

DURATION OF CONSTRUCTION ACTIVITIES	CORRECTION OF THE PERMISSIBLE NOISE LIMITS L _{Aeq} , T (dB)
Up to 2.5 hours	10
2.5 to 8 hours	5
More than 8 hours	0

B. Lenders Requirements

In addition, the IFC General EHS Guidelines require that noise impacts from a project should not exceed the WHO noise standards which are presented in the table below or result in a maximum increase in background levels of 3dB at the nearest off-site point of reception.

Table A-11 WHO Noise Standards (At off-site receptors)

RECEPTOR	ONE HOUR L _{Aeq} (dB(A))	
	DAYTIME (07:00 – 22:00)	NIGHTTIME (22:00 – 07:00)
Residential, Institutional, Educational	55	45
Industrial, Commercial	70	70

Furthermore, the following requirements have also been specified in the IFC EHS noise guidelines:

- No employee should be exposed to a noise level greater than 85 dB (A) for duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85dB (A), the peak sound level reaches 140dB(C), or the average maximum sound level reaches 110dB (A). Hearing protective devices provided should be capable of reducing sound level at the ear to at least 85dB (A).
- For every 3dB (A) increase in sound levels, the allowed exposure period or duration should be reduced by 50%.
- Where feasible, use of acoustic insulating materials isolations of the noise source and other engineering controls should be investigated and implemented prior to the issuance of hearing protection devices as the final control mechanism.
- Medical hearing checks on workers exposed to high noise levels should be performed periodically.

Soil, Geology and Groundwater

A. National Requirements

Soil

The soil quality standards referenced in the table below are from the Executive Regulations for the Prevention and Remediation of Soil Pollution of the Environment Law issued by Royal Decree No. (M/165) as of 19/11/1441 AH. These standards set out the KSA limits of soil quality in terms of defining contamination and quality levels necessary for remediation.

It should be noted that the table below contains the most applicable soils standards from the Regulations based on the Project type. Other standards which are included in the Executive Regulations relating to aliphatic halogen compounds, other organic compounds and radioactive agents have not been included as they are not considered applicable to the Project.

Table A-13 Soil Quality Standards

CHEMICAL SUBSTANCE	UNITS	CLASSIFICATION OF THE SOIL PARTICLES SIZE										REMARKS
		COARSE SOIL (>75 MICRON)					FINE SOIL (<75 MICRON)					
		LAND USE TYPES										
		NATURAL AREA	AGRICULTURAL	RESIDENTIAL / PARKS	COMMERCIAL	INDUSTRIAL	NATURAL AREA	AGRICULTURAL	RESIDENTIAL / PARKS	COMMERCIAL	INDUSTRIAL	
		ACTION LEVEL										
pH (in 0.01M CaCl ²)	pH units	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	
Cyanide (free)	mg/kg	0.9	0.9	0.9	8	8	0.9	0.9	0.9	8	8	
Fluoride	mg/kg	2.0	2.0	2.0	2.000	2.000	200	200	200	2.000	2.000	
Sulphur (elemental)	mg/kg	500	500	500	500	500	500	500	500	500	500	
Metals												
Antimony	mg/kg	20	20	20	40	40	20	20	20	40	40	
Arsenic (inorganic) (As)	mg/kg	17	17	17	26	26	17	17	17	26	26	
Barium (non-barite) (Ba)	mg/kg	750	750	500	2,000	2,000	750	750	500	2,000	2,000	
Barite-barium	mg/kg	10,000	10,000	10,000	15,000	14,000	10,000	10,000	10,000	15,000	140,000	
Beryllium (Be)	mg/kg	5	5	5	8	8	5	5	5	8	8	
Boron (saturated phase extract) (B)	mg/kg	3,3	3,3	3,3	5	5	3,3	3,3	3,3	5	5	
Cadmium (Cd)	mg/kg	3,8	1,4	10	22	22	3,8	1,4	10	22	22	
Chromium (hexavalent) (Cr ⁺⁶)	mg/kg	0.4	0.4	0.4	1.4	1.4	0.4	0.4	0.4	1.4	1.4	
Chromium (total)	mg/kg	64	64	64	87	87	64	64	64	87	87	
Cobalt (Co)	mg/kg	20	20	20	300	300	20	20	20	300	300	
Copper (Cu)	mg/kg	63	63	63	91	91	63	63	63	91	91	
Lead (pb)	mg/kg	70	70	140	260	600	70	70	140	260	600	
Mercury (inorganic)	mg/kg	12	606	606	24	50	12	606	606	24	50	
Molybdenum (Mo)	mg/kg	4	4	4	40	40	4	4	4	40	40	
Nickel (Ni)	mg/kg	45	45	45	89	89	45	45	45	89	89	
Selenium (Se)	mg/kg	1	1	1	2.9	2.9	1	1	1	2.9	2.9	
Silver	mg/kg	20	20	20	40	40	20	20	20	40	40	

CHEMICAL SUBSTANCE	UNITS	CLASSIFICATION OF THE SOIL PARTICLES SIZE										REMARKS
		COARSE SOIL (>75 MICRON)					FINE SOIL (<75 MICRON)					
		LAND USE TYPES										
		NATURAL AREA	AGRICULTURAL	RESIDENTIAL / PARKS	COMMERCIAL	INDUSTRIAL	NATURAL AREA	AGRICULTURAL	RESIDENTIAL / PARKS	COMMERCIAL	INDUSTRIAL	
		ACTION LEVEL										
Thallium (Tl)	mg/kg	1	1	1	1	1	1	1	1	1	1	
Tin (Sn)	mg/kg	5	5	5	300	300	5	5	5	300	300	
Uranium (U)	mg/kg	33	23	23	33	300	33	23	23	33	300	
Vanadium (V)	mg/kg	130	130	130	130	130	1360	130	130	130	130	
Zinc (Zn)	mg/kg	200	200	200	360	360	200	200	200	360	360	
Hydrocarbons												
Benzene (C ⁶ H ⁶)	mg/kg	0.078	0.073	0.073	0.078	0.078	0.046	0.046	0.046	0.046	0.046	Topsoil
Benzene (C ⁶ H ⁶)	mg/kg	0.078	0.078	0.078	0.078	0.078	0.046	0.046	0.046	0.046	0.046	Subsoil
Toluene (C ⁷ H ⁸)	mg/kg	0.12	0.12	0.12	0.12	0.12	0.52	0.52	0.52	0.52	0.52	Topsoil
Toluene (C ⁷ H ⁸)	mg/kg	0.12	0.12	0.12	0.12	0.12	0.52	0.52	0.52	0.52	0.52	Subsoil
Ethylbenzene (C ⁸ H ¹⁰)	mg/kg	0.14	0.018	0.14	0.14	0.14	0.073	0.073	0.073	0.073	0.073	Topsoil
Ethylbenzene (C ⁸ H ¹⁰)	mg/kg	0.14	0.14	0.14	0.14	0.14	0.073	0.073	0.073	0.073	0.073	Subsoil
Xylenes (C ⁸ H ¹⁰)	mg/kg	1.9	0.003	1.9	1.9	1.9	0.99	0.99	0.99	0.99	0.99	Topsoil
Xylenes (C ⁸ H ¹⁰)	mg/kg	1.9	1.9	1.9	1.9	1.9	0.99	0.99	0.99	0.99	0.99	Subsoil
Styrene (C ⁸ H ⁸)	mg/kg	0.8	0.8	0.8	0.8	0.8	0.68	0.68	0.68	0.68	0.68	
F1: C6 to C10	mg/kg	210	24	24	270	270	210	210	2140	320	320	Topsoil
F2: C10 to C16	mg/kg	150	130	130	260	260	150	150	150	260	260	Topsoil
F3: C16 to C34	mg/kg	300	300	300	1,700	1,700	1,300	1,300	1,300	2,500	2,500	Topsoil
F4: C34 to C50	mg/kg	2,800	2,800	2,800	3,300	3,300	5,600	5,600	5,600	6,600	6,600	Topsoil
F1: C6 to C10	mg/kg	420	30	30	440	440	420	420	420	640	640	Subsoil
F2: C10 to C16	mg/kg	300	160	160	520	520	300	300	300	520	520	Subsoil
F3: C16 to C34	mg/kg	600	600	600	3,400	3,400	2,600	2,600	2,600	4,300	4,300	Subsoil
F4 C34 to C50	mg/kg	5,600	5,600	5,600	6,600	6,600	10,000	10,000	10,000	10,000	10,000	Subsoil

Groundwater

A. National Requirements

Under the MEWA standards for Protection of Aquatic Media from Pollution, the groundwater standards relate only for groundwater bodies that will be used for drinking water. In the absence of standards for non-drinking water groundwater bodies, the standards as outlined in Appendix B of the Ambient Water Quality Standards PME (2012) have been referenced in the table below.

Table A-14 Standards for Ambient Groundwater Quality

PARAMETER	CONCENTRATION LIMIT	PARAMETER	CONCENTRATION LIMIT
BOD	Not available	Carbon tetrachloride	0.005
COD	Not available	Chlorine (residual)	<0.0
Total Oil & Grease	0	Chlorinated hydrocarbons (total)	0.001
TKN (organic N)	5	Chloroform	-
TOC	-	Cyanide (free)	0.001
Phosphorus (total)	0.03	Fluoride	0.2
Phosphorus (PO ₄)	-	Furans	1x10 ⁻⁸
Ammonia (as NH ₃)	0.03	Hexachlorobenzene	0.007
Chloride (as Cl)	-	Lindane	0.0002
Total inorganic nitrogen (as NO ₂ & NO ₃)	30	Mirex	1x10 ⁻⁸
Sodium	150	MTBE	0.02
Sulphate	-	PAHs	0.0002
Sulphide	0.002	PCB	1.9x10 ⁻⁸
Aluminium	0.2	Pentachlorophenol	0.0005
Arsenic	0.005	Aldrin	2.2x10 ⁻⁸
Barium	1	Chlordane	0.002
Cadmium	0.005	DDT	1.7x10 ⁻⁵
Chromium (total)	0.1	Dieldrin	4x10 ⁻⁸
Chromium (hexavalent)	0.005	Endrin	0.001
Cobalt	0.05	Heptachlor	0.0004
Copper	0.05	Toxaphene	0.002
Iron	0.2	Phenols	0.005
Lead	0.005	Dioxins	3x10 ⁻⁸
Manganese	0.1	Toluene	0.002
Mercury	0.001	TPH	0.2
Nickel	0.02	Vinyl chlorides	0.001
Silver	0.1	Xylenes	0.005
Zinc	0.02	E coli	<10 (count / 100ml)

B. Lenders Requirements

EPFI's

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.

Solid Waste and Wastewater

A. National Requirements

Appendix 4 of the Executive Regulations outlines treatment levels dependent on the activity. The level of treatment based on the type of discharge to the soil and land are shown in the tables below.

Table A-16 Wastewater Treatment Techniques

TREATMENT LEVEL	PARAMETERS TO BE REMOVED	EXAMPLE OF TREATMENT PROCESS
A – Pre-treatment	Solids	Filtering solids
B – Primary Treatment	Solids as well as easily precipitated materials	Primary filtration
C – Secondary Treatment	Most solids and Biological Oxygen Demand (BOD)	Biological treatment, chemical treatment, ponds
D – Removing Nutrients	Nutrients after removing solids	Biological and chemical treatment
E - Disinfection	Bacteria and viruses	The use of ultraviolet rays, chlorination treatment

Table A-17 Discharge of Injection Options for Treated Wastewater

DISCHARGE OR INJECTION OPTIONS FOR TREATED WASTEWATER	MINIMUM LEVEL OF TREATMENT	RECOMMENDED LEVEL OF TREATMENT
Discharge of treated wastewater to the soil/ lands		
Irrigation:	C	C, E
- Agricultural Land		
- Irrigated green spaces		
- Injection into Groundwater		
Leak to:	C	C, D
- Natural Soil		
- Groundwater		

B. Lenders Requirements

Waste

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

- Establish waste management priorities at the outset of activities.
- Identify EHS risks and impacts with regards to waste generation and its consequences.
- Establish a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoid or minimize the generation waste materials, as far as practicable.
- Identify where waste generation cannot be avoided but can be minimized or where opportunities exist for, recovering and reusing waste.
- Where waste cannot be recovered or reused, identify means of treating, destroying, and disposing of it in an environmentally sound manner.

Where waste cannot be recovered or reused, identify means of treating, destroying, and disposing of it in an environmentally sound manner.

With regards to hazardous waste, IFC PS 3 requires the following:

- Adoption of GIMP for environmentally sound disposal while adhering to the limitations applicable to its transboundary movement; and
- When hazardous waste disposal is conducted by third parties, the PS requires the use of contractors that are reputable and legitimate enterprises, licensed by the relevant government regulatory agencies and obtain chain of custody documentation to the final destination. Also, the PS requires companies to ascertain whether licensed disposal sites are being operated to acceptable standards and where they are. Where this is not the case, companies should reduce waste sent to such sites and consider alternative disposal options, including the possibility of developing their recovery or disposal facilities at the project site.

Wastewater

The IFC/WBG General EHS Guidelines establish general requirements for direct or indirect discharge of wastewater from utility operations or storm water to the environment.

'Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment'.

However, wastewater effluent pollutant limits are only established for sanitary wastewater for discharge to the sanitary sewer systems. The following table provides the indicative values for treated sanitary wastewater effluent limits as established by the World Bank General EHS Guidelines (2007) (ref. Table 1.3.1 of IFC EHS Guidelines).

Table A-18 Indicative Values for Treated Sanitary Sewage Discharges

POLLUTANTS	UNITS	GUIDELINE VALUE
pH	pH Units	6 – 9
BOD	mg/l	30

POLLUTANTS	UNITS	GUIDELINE VALUE
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorus	mg/l	2
Oil and Grease	mg/l	10
Total Suspended Solids	mg/l	50
Total Coliform Bacteria	MPN/100ml	400