

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF
AR RASS SOLAR INDEPENDENT PV POWER PLANT (AR-
SIPVPP), AR RASS , KINGDOM OF SAUDI ARABIA”
MARCH 2023 TO JUNE 2023**

**VOLUME-1 ENVIRONMENTAL AND SOCIAL
IMPACT ASSESSMENT REPORT
JULY- 2023**



2023

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ESTABLISHMENT
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Submitted to
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WATER AND POWER PROJECTS (ACWA
POWER), KSA,**

ENVIRONMENTAL BALANCE COMPANY

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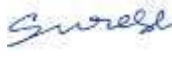
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LIST OF ABBREVIATIONS

ASL	: Above Sea Level
AR-SIPVPP	: Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass
As	: Arsenic
Cd	: Cadmium
CFC	: Chlorofluorocarbon
CH₄	: Methane
CITIES	: Consortium for International Trade of Endangered Spices
Cm/sec	: Centimeter per Second
cm	: Centimeter
Cm/sec	: Centimeter/Second
dB	: Decibel
E	: East
EBC	: Environmental Balance Company
EBA	: Environmental Baseline Assessment
EMMP	: Environmental Management and Monitoring Plan
EMP	: Environmental Management Plan
EIS	: Environmental Impact Study
EPA	: Environmental Protection Agency
ERP	: Emergency Remediation Plan
EIA	: Environmental Impact Assessment
EMMP	: Effluent Treatment Plant
EMS	: Environmental Management System
FRM	: Federal Reference Method
GAMEP	: General Authority for Meteorology and Environmental Protection
GERRI	: General Environmental Regulations and Rules for Implementation
GHG	: Green House Gases
Hg	: Mercury
hr	: Hour
ICZM	: Integrated Coastal Zone Management
IFC	: International Finance Corporation
IMDG Code	: International Maritime Dangerous Goods Code
IUCN	: International Union for the Conservation of Nature
Km	: Kilo Meters
km²	: Square Kilo Meters
lpm	: liter per minute
m	: Meters
m²	: Square Meters
m³	: Cubic Meters
mm	: Millimeters
MPA's	: Marine Protected Areas
MSL	: Mean Sea Level
N	: North
NAAQS	: National Ambient Air Quality Standards
NCEC	: National Center for Environmental Compliance



NCWCD	: National Commission for Wildlife Conservation and Development
NO₂	: Nitrogen dioxide
NMHC	: Non-Methane Hydrocarbon
NTU	: Nephelometric Turbidity Unit
OEMP	: Operation Environmental Management Plan
PEL	: Public Environmental Law
PDCA	: plan-do-check-act
PAH	: Polyaromatic hydrocarbons
Pb	: Lead
PEL	: Public Environmental Law
PME	: Presidency of Meteorology and Environmental Protection
RCER	: Royal Commission Environmental Regulations
ROI	: Regions of Influence
S	: South
sec	: Seconds
slpm	: standard liter per minute
SO₂	: Sulphur dioxide
TDS	: Total Dissolved Solids
THC	: Total Hydrocarbon
TNMHC	: Total Non-Methane Hydrocarbon
TPH	: Total Petroleum Hydrocarbons
TSE	: Treated Sewage Effluent
TSS	: Total Suspended Solids
UNEDP	: United Nations Environmental and Development Program
USEPA	: United States Environmental Protection Agency
W	: West



GLOSSARY

Activity	Any action needed for the design, construction and completion of a project.
Adverse (Impact)	A negative impact upon a receptor as a result of the Project. It includes short and long term negative and reversible impacts. The scale of the impact is further defined using the ESIA matrix.
Ambient Air Quality Limits	Ambient air quality limits are concentrations or air quality indicators recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about their effects on health and on the environment. They can be used as a benchmark to indicate whether air quality is being degraded.
Archaeology	The scientific study of the physical evidence of past human societies recovered through collection, artefact analysis, and excavation. Archaeologists not only attempt to discover and describe past cultures but also to formulate explanations for the development of cultures. Conclusions drawn from study and analyses provide answers and predictions about human behaviour that add, complement, and sometimes correct the written accounts of history and prehistory.
Baseline Conditions	A description of the physical, biological and social setting in which a project is to be developed, for example, nature of terrain/landscape, location of populated areas, ecological resources, agriculture, air quality and noise etc.
Biodiversity	Biodiversity is the variability among living organisms from all sources, including, amongst others, terrestrial, and other ecosystems and the ecological complexes of which they are a part, including diversity within species, between species and of ecosystems.
Chance Find	An archaeological site or object that was unknown prior to discovery during construction (despite best efforts to identify all sites prior to construction through cultural heritage surveys).
Contractor	Any person or company employed under contract (irrespective of period of contract or employment).
Consultation	The process of formally consulting or discussing a subject. For the purposes of this document, consultation involves two-way communication between the project developers and affected or interested stakeholders.
Contaminated Water	Water contaminated by pollutants from on- or off-site activities; e.g. concrete-laden water, runoff from personnel wash areas and chemical spills. Contaminated water must be treated to ensure that water released into the receiving environment meets minimum standards and guidelines.
Contamination	The introduction by man, directly or indirectly, of substances to the environment. Contaminants are biological, chemical, physical or radiological substances.
Cumulative Impact Assessment	An assessment of the cumulative effects of the Project together with other developments that will also have effects within the Project's Area of Influence.
Cumulative Impacts	Those 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 (IFC PS1).
Data Gap Analysis	Review of available information sources to identify any areas for which further data collection would be advantageous to characterize baseline conditions.
Demography	The statistical study of the characteristics of human populations.
Direct Impacts	Impacts that result from a direct interaction between a planned project activity and the receiving environment.
Discharge (emission, effluent, waste)	Any release of pollutant(s) into the environment, be it of a gaseous, liquid or solid nature, or a combination thereof.
Ecology	Term used to describe the biological community structure in an area, including presence of rare or endangered species.
Ecosystem	A biological community of interacting organisms and their physical environment.
Ecosystem Services	The benefits that people, including businesses, obtain from ecosystems (IFC, 2012). There are three broad categories: ➤ Provisioning services: The products obtained from ecosystems such as: crops, livestock, fish, shellfish, and game, wild foods and plants; water for drinking, irrigation, and industrial purposes; and biopharmaceuticals, construction materials and biomass or renewable energy. ➤ Regulating services: The benefits obtained from the regulation of ecosystem processes including: local climate regulation and carbon storage and sequestration; natural hazard mitigation; purification of water and air; control of pests and disease; and pollination. ➤ Cultural services: The cultural, educational, and spiritual benefits obtained from ecosystems including: cultural, spiritual, or religious inspiration from cultural heritage and/or spiritual or sacred sites; opportunities for recreation such as sport, hunting, fishing, ecotourism; and opportunities for scientific exploration, knowledge building and education.
Emission	The direct or indirect release of substances, vibration, heat or noise from installation into air, water or land.
Environmental and Social Impact Assessment	Systematic process of evaluating the environmental and social impacts of an activity or process on the environment.
Environmental and Social Management Plan	A tool used to identify the environmental and social management and mitigation actions required to implement the project in accordance with the requirements of the International Finance Corporation's (IFC) Performance Standards and applicable national legislation.
Environmental Aspect	Attribute or constituent of the environment (that is, Air Quality; Marine Water; Waste Management; Geology, Seismicity, Soil, and Groundwater; Terrestrial Ecology; Terrestrial Ecology; Noise; Traffic; Socio-economic) that may be impacted by the proposed project.



Environmental Impact	Positive or negative impact that occurs to an environmental component as a result of the proposed project. This impact can be directly or indirectly caused by the project's different phases (that is, construction, operation, and decommissioning).
Fauna	All living biological creatures, usually capable of motion, including insects and predominantly of protein-based consistency.
Flood line	The line or mark to which a flood could rise every 50 (1:50 year flood line) or 100 (1:100-year flood line) years.
Flora	All living plants, grasses, shrubs, trees etc., which are typically incapable of easy natural motion and capable of photosynthesis.
Geomorphology	Refers to the study of the evolution and configuration of landforms and the processes which shape them.
Global Warming	Global warming is an average increase in the temperature of the atmosphere near the Earth's surface and in the troposphere, which can contribute to changes in global climate patterns.
Good International Industry Practices	The exercise of professional skill, diligence prudence and foresight that would be reasonably expected from skilled and experienced professionals may find when evaluating the range of pollution prevention and control techniques available to a project, which may include, but not be limited to, varying levels of environmental degradation and environmental assimilative capacity, as well as varying levels of financial and technical feasibility.
Greenhouse Gases	Atmospheric gases considered to be contributing to the greenhouse effect by absorbing and emitting radiation, -They include carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (NO ₂), and water vapour.
Grievance	Formal complaints by individuals, groups or organizations who feel they have been adversely affected by project-related activities.
Grievance Mechanism	Process of recording and addressing grievances so that they can be tracked through to a resolution.
Groundwater	Water that fills the natural openings in below-surface rock or unconsolidated sands.
Habitat	A terrestrial, geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment (IFC, PS6).
Hazard	The potential to cause harm, including ill health or injury; damage to property, plant, products or the environment; production losses or increased liabilities.
Hazardous Waste	Waste that poses potential harm to human health and the environment.
Heritage Resources	Any place or object of cultural, archaeological significance in terms of the Historical Monuments Act.
Hydrocarbon	Organic chemical compounds of hydrogen and carbon atoms that form the basis of all petroleum products. They may exist as gases, liquids or solids, examples being methane, hexane and paraffin.
Hydro morphological	Physical characteristics of the shape, boundaries and content of a water body.



Impacts	Changes to the existing environment, whether adverse or beneficial, wholly or partially arising from the Project.
Impact Magnitude	Measure of the degree of change from the baseline conditions.
Impact Significance	Measure of how important or consequential an impact is, based on its magnitude, and the sensitivity of the affected receptors.
Indirect Impacts	Impacts that follow on from the primary interactions between the Project and its environment because of subsequent interactions in the environment (e.g. loss of part of a habitat could affect the population of a species over a wider area).
Induced Impacts	Impacts that result from other knock on activities that may happen as a consequence of the Project (e.g. they tend to be social in nature, such as immigration, new businesses set up to cater for increased traffic on roads).
International Finance Corporation Performance Standards	The Performance Standards provide guidance on how to identify environmental and social risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way. There are eight Performance Standards that clients must meet throughout the life of investment by IFC.
Land Use	The arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it. This definition establishes a direct link between the land cover and the actions of people in their environment; often includes natural or recreational areas such as parks.
Landscape	All the visible features of an area of land, often considered in terms of their aesthetic appeal.
Likelihood	The probability that an activity or effect will occur.
Macroinvertebrates	Invertebrate fauna that can be captured by a 500-micron net or sieve. This includes arthropods (insects, mites, scuds and crayfish), molluscs (snails, limpets, mussels and clams), annelids (segmented worms), nematodes (roundworms), and Platyhelminthes (flatworms).
Mitigation Measures	Management measures put forward to prevent, reduce and where possible, offset any adverse environmental or socio-economic impacts. For the purposes of this document, these measures also include enhancement strategies aimed at increasing beneficial impacts.
Oligotrophic	Low productivity and nutrient content.
Pollutant	A substance, material or energy whose discharges to, or concentration in, the environment as a result of industrial activity is subject to regulations and/or guidelines, which may be expressed in terms of composition, concentration, total discharge rate, pollutant discharge rate or a combination of these.
Pollution	Any emission as a result of human activity which may be harmful to human health or the quality of the environment, cause offence to any human senses, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment.
Project Area of Influence	Those areas that are likely to be affected by the main Project facilities, including the main Project Area for this Project, plus the area related to any Associated Facilities.



Receptor	An entity that receives a contaminant or pollutant from the Project activities and which may interact with or be affected by it.
Residual Impacts	Impacts that remain after mitigation measures, including those incorporated into the project's base case design (i.e. embedded mitigation) and those developed in addition to the base case design, have been applied.
Reversibility	The degree and speed with which a receptor can recover from an impact.
Risk	The probability that a specified event will occur and the severity of the consequences of the event.
Scoping	Early stage in the ESIA process that appraises the likely key issues requiring detailed assessment. A scoping process (in relation to IFC PS1) is the establishment and maintenance of a process for identifying the initial environmental and social risks and impacts of a project. The aspects of the project (i.e., type, scale and location) along with available baseline data is used to guide the scope and level of effort devoted to the risk and impacts identification in the ESIA. The process also involves a mechanism for the collection of comments made by different stakeholders
Sensitivity	The recovery rate of the receptor from disturbance or degradation.
Species	A species is often defined as a group of individuals or communities that have the potential to multiply and reproduce under natural conditions.
Species (ecological concern)	Species that have a high ecological contribution to the ecosystem in which they exist. This can also include species that are facing a risk of being categorized as threatened, endangered or extinct in the near future.
Spill (environmental)	A spill is any loss of containment that reaches the environment, irrespective of the quantity recovered.
Stakeholder	Any individual, group or organization potentially affected by a project, or which has an interest in, or influence over, a project.
Stakeholder Engagement	As stated by IFC in PS 01 "Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts." Thus, it is an activity covering different types of interactions with stakeholders over the life of a project. It can include, but is not limited to disclosure of Project information and consultation during preparation of an ESIA Report.
Stakeholder Engagement Plan	A Stakeholder Engagement Plan forms part of the ESIA documentation and is intended to provide a plan and implementation strategy to guide stakeholder engagement throughout the project lifecycle.
Stratification	The occurrence of more or less horizontal water layers in the sea as a consequence of differences in density resulting from salinity (halocline) or temperature (thermocline)
Sustainable Development	Development that meets the needs of the present without comprising the ability of future generations to meet their needs.
Trans boundary Impacts	Impacts that may affect countries other than the country in which a project will be constructed and operated
Unplanned Event	Activities or events that are not anticipated to occur in the normal course of operations of a project including accidents and malfunctions.



Visual Impact	Impact on specific views and on the general visual amenity experienced by people.
Waste	Wide ranging term taken to include any scrap material, effluent or unwanted surplus substance or article which requires to be disposed of. Explosive and radioactive wastes are included. Emissions are excluded.
World Heritage Site	A natural or man-made site, area, or structure recognized as being of outstanding international importance and therefore requires special protection. Sites are nominated to and designated by the World Heritage Convention (an organization of UNESCO).



Executive Summary

Background

This Environmental and Social Impact Assessment (ESIA) study for Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project has been prepared in compliance with the Appendix 2.4 of General Environmental Regulations and Rules for Implementation (GERRI, 2001) of NCEC -KSA and Equator Principles July 2020 -ESIA Guidelines (IFC Standards 2012). The environmental assessment study assures compliance with the regulatory requirements; identifies and analyzes sensitive components of the existing environment; determines the type, nature and importance of the probable environmental impacts during construction and operation; identifies and recommends practical effective mitigation measures; recommends a framework for an environmental management and monitoring plan for the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project; and ensures that all stakeholders deemed to be influenced by the projects or activities are fully considered.

E.1 Project Overview

M/S ACWA Power Company (Saudi Listed Joint Stock Company) Saudi Arabia have commissioned the Environmental Balance Establishment to undertake an Environmental and Social Impact Assessment (ESIA) Study for the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project, In conformity with Appendix 2.4 of GER-NCEC and Equator Principles July 2020 ESIA Procedure; this project has been classified as category III and hence requires a comprehensive Environmental and Social Impact Assessment (ESIA) prior to commencement of the project execution. The main objective of this ESIA is to assess in advance the impacts from the construction and operation phases of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project and to identify mitigation and control measures.

This ESIA will cover the construction and operation phases of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project to meet the demand of Potable water service to Riyadh and Qassim due to progressive increased stress on existing Power Plants.

E.2 Project Description and Scope of Assessment

The current population of **Saudi Arabia** is **36,900,327 as of Thursday, June 10, 2023**, based on World meter elaboration of the latest United Nations data. Saudi Arabia 2020 population is estimated at **36,900,327** people at midyear according to UN data.



Saudi Arabia officially known as the Kingdom of Saudi Arabia (KSA), is the largest Arab state in Western Asia by land area (approximately 2,150,000 km² (830,000 sq. mi), constituting the bulk of the Arabian Peninsula) and the second-largest in the Arab world (after Algeria). It is the only nation with both a Red Sea coast and a Persian Gulf coast. Its population is estimated to consist of 16 million citizens and an additional nine million registered foreign expatriates.

Table E.1 Population of Saudi Arabia (2023 and historical)

Population of Saudi Arabia (2023 and historical)

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Saudi Arabia Global Rank
2023	36,947,025	1.48 %	538,205	28,998	30.6	2.36	17	83.5 %	30,846,442	0.46 %	8,045,311,447	40
2022	36,408,820	1.28 %	458,424	28,998	30.2	2.39	17	83.3 %	30,329,753	0.46 %	7,975,105,156	41
2020	35,997,107	0.47 %	169,745	-1,025,295	29.2	2.47	17	81.3 %	29,255,576	0.46 %	7,840,952,880	41
2015	32,749,848	2.17 %	667,584	60,337	28.3	2.64	15	80.2 %	26,249,243	0.44 %	7,426,597,537	41
2010	29,411,929	3.81 %	1,002,857	236,962	25.3	2.85	14	76.5 %	22,512,101	0.42 %	6,985,603,105	40
2005	24,397,644	2.52 %	570,051	481,349	23.2	3.24	11	79.3 %	19,358,664	0.37 %	6,558,176,119	46
2000	21,547,390	2.67 %	531,707	17,241	21.2	4.12	10	76.9 %	16,579,826	0.35 %	6,148,898,975	48
1995	18,888,857	3.37 %	576,819	27,095	19.3	4.95	9	78.0 %	14,739,559	0.33 %	5,743,219,454	48
1990	16,004,763	4.42 %	622,904	186,898	18.2	5.83	7	78.1 %	12,503,513	0.30 %	5,316,175,862	51
1985	12,890,245	4.85 %	543,707	163,926	17.0	6.70	6	74.3 %	9,581,553	0.27 %	4,861,730,613	53
1980	10,171,710	5.19 %	454,833	148,004	16.2	7.19	5	63.1 %	6,415,124	0.23 %	4,444,007,706	58
1975	7,897,544	5.28 %	358,271	132,741	16.6	7.37	4	54.9 %	4,334,558	0.19 %	4,069,437,231	65
1970	6,106,191	4.17 %	225,454	63,988	16.2	7.58	3	46.5 %	2,840,506	0.17 %	3,695,390,336	75
1965	4,978,922	3.63 %	162,672	28,951	16.1	7.66	2	37.7 %	1,877,805	0.15 %	3,337,111,983	83
1960	4,165,563	3.07 %	116,731	7,608	16.5	7.63	2	30.7 %	1,277,054	0.14 %	3,019,233,434	81
1955	3,581,910	3.00 %	98,443	2,108	17.3	7.59	2	25.8 %	923,917	0.13 %	2,746,072,141	83

Source: **World meter** (www.worldometers.info)

Elaboration of data by United Nations, Department of Economic and Social Affairs, Population Division. [World Population Prospects: The 2022 Revision](#). (Medium-fertility variant).

Saudi Arabia Population Forecast



Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Saudi Arabia Global Rank
2025	37,989,969	1.08 %	398,572	28,998	31.5	2.30	18	83.8 %	31,842,626	0.46 %	8,191,988,453	42
2030	40,461,368	1.27 %	494,280	38,997	33.4	2.16	19	84.4 %	34,142,975	0.47 %	8,546,141,327	40
2035	42,755,976	1.11 %	458,922	38,997	34.8	2.06	20	84.6 %	36,170,029	0.48 %	8,879,397,401	40
2040	44,881,078	0.97 %	425,020	38,997	36.2	1.99	21	84.4 %	37,878,811	0.49 %	9,188,250,492	42
2045	46,785,937	0.83 %	380,972	38,997	37.4	1.93	22	84.2 %	39,396,408	0.49 %	9,467,543,575	44
2050	48,374,543	0.67 %	317,721		38.8	1.88	23	84.2 %	40,708,624	0.50 %	9,709,491,761	43

Source: **world meter** (www.Worlometers.info)

Elaboration of data by United Nations, Department of Economic and Social Affairs, Population Division. [World Population Prospects: The 2022 Revision](#). (Medium-fertility variant).

E.4 Main Cities by Population in Saudi Arabia

(includes boroughs, districts, urban agglomerations, etc.)

#	CITY NAME	POPULATION
14	Hafar Al-Batin	271,642
15	Ha'il	267,005
16	Najran	258,573
17	Al Jubayl	237,274
18	Abha	210,886
19	Yanbu	200,161
20	Khobar	165,799
21	Arar	148,540
22	Sakakah	128,332
23	Jizan	105,198
24	Qurayyat	102,903
25	Dhahran	99,540
26	Al Qatif	98,259

#	CITY NAME	POPULATION
1	Riyadh	4,205,961
2	Jeddah	2,867,446
3	Mecca	1,323,624
4	Medina	1,300,000
5	Sultanah	946,697
6	Dammam	768,602
7	Ta'if	530,848
8	Tabuk	455,450
9	Al Kharj	425,300
10	Buraydah	391,336
11	Khamis Mushait	387,553
12	Al Hufuf	293,179
13	Al Mubarraz	290,802



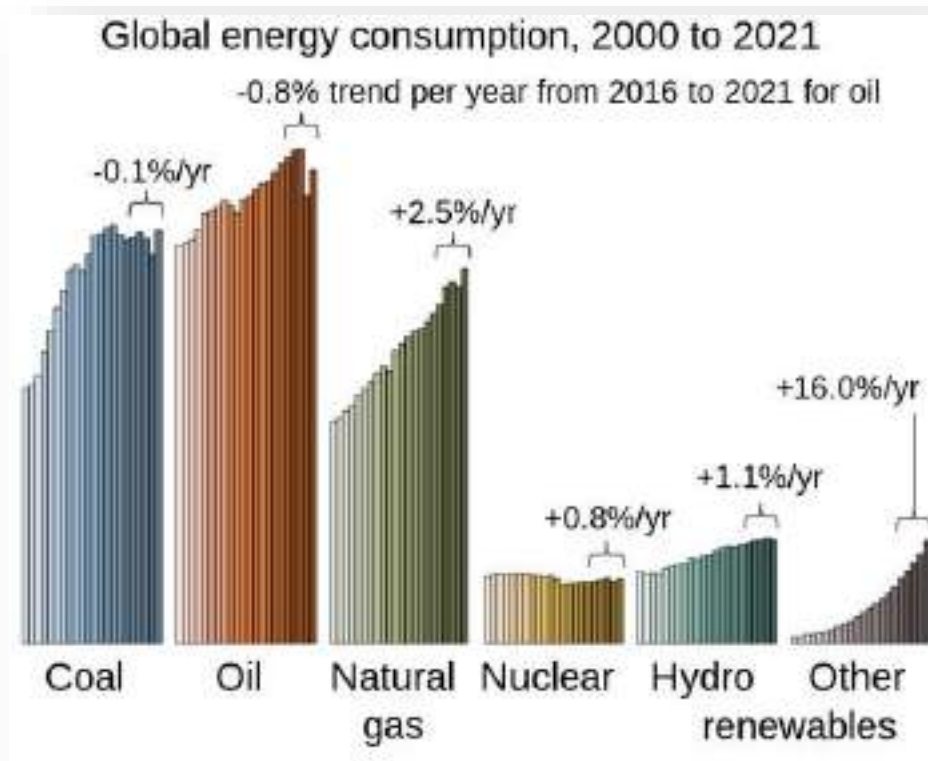
#	CITY NAME	POPULATION
50	Samitah	26,945
51	Al Wajh	26,636
52	Al Bukayriyah	25,153
53	An Nimas	24,153
54	As Sulayyil	24,097
55	Turabah	23,235
56	Al Jumum	22,207
57	Duba	22,000
58	At Taraf	21,386
59	Qaisumah	20,685
60	Al Battaliyah	16,606
61	Al Munayzilah	16,296

#	CITY NAME	POPULATION
27	Al Bahah	88,419
28	Tarut	85,371
29	Qal`at Bishah	81,828
30	Ar Rass	81,728
31	Ash Shafa	72,190
32	Sayhat	66,702
33	Al Mithnab	60,870
34	Al Khafji	54,857
35	Ad Dawadimi	54,474
36	Sabya	54,108
37	Az Zulfi	53,144
38	Abu `Arish	49,171
39	Safwa	45,876
40	Afif	45,525
41	Rabigh	41,759
42	Rahimah	41,188
43	Turaif	40,819
44	Tubarjal	40,019
45	Ad Dilam	35,371
46	Umm Lajj	33,874
47	Al-`Ula	32,413
48	Abqaiq	29,474
49	Badr Hunayn	27,257



Saudi Arabia **relies almost entirely on gas and oil for its electricity**. In 2021, the shares of gas and oil in the country's power mix were 61% and 39% respectively. Wind and solar had a near-zero share of power production.

E.3 World energy supply and consumption is global production and preparation of fuel, generation of electricity, energy transport, and energy consumption. It is a basic part of economic activity. It includes heat, but not energy from food.



Electricity generation is **40% from Oil 52% from Natural Gas and 8% from steam**. Generation capacity is approximately 55 GW. A looming energy shortage requires Saudi Arabia to increase its capacity. Capacity is planned to be increased to 120 GW by 2032.

Saudi Arabia progress on clean electricity transition has been near-zero

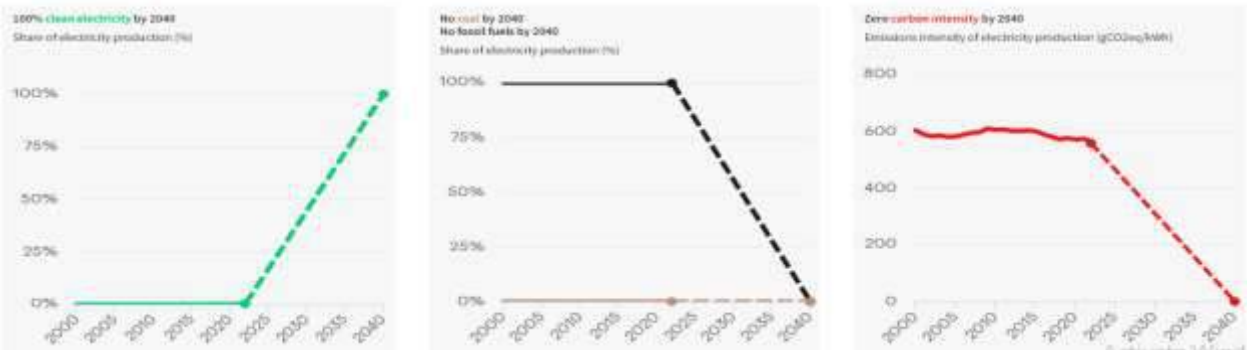
Saudi Arabia relies almost entirely on gas and oil for its electricity. In 2021, the shares of gas and oil in the country's power mix were 61% and 39% respectively. Wind and solar had a near-zero share of power production.



Saudi Arabia is the only country among the G20 that relies almost entirely on fossil fuels for its electricity, with no progress in the last decade. This puts it ahead of even South Africa (86%) and well ahead of the global average (62%) for fossil generation share.

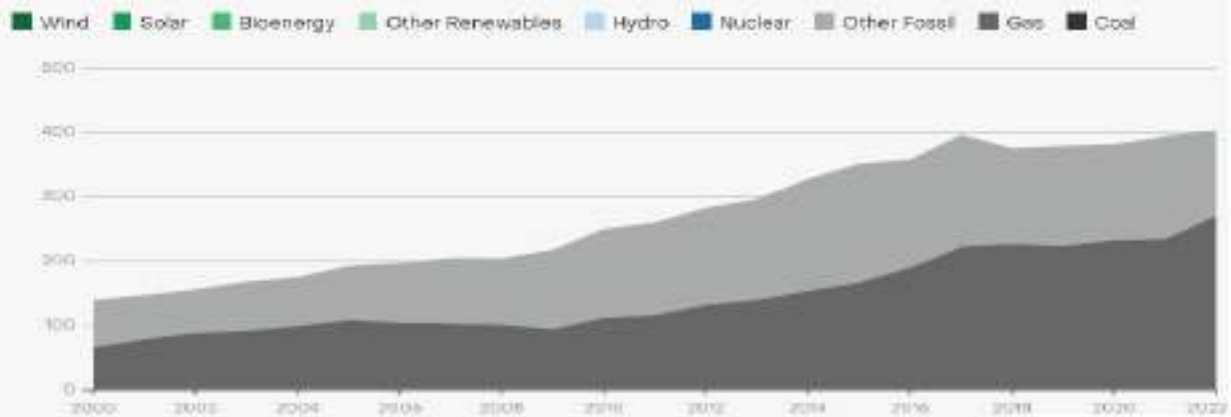
As per the IEA, to limit global temperature rises to 1.5C, Saudi Arabia should fully decarbonise electricity by 2035 and become net zero by 2050. In October 2021, Saudi Arabia pledged to become net zero by 2060—but without an oil exit plan—and to source 50% of its power from renewables by 2030.

Progress towards clean power targets Saudi Arabia 2000–2040



Saudi Arabia electricity generation by source

Terawatt hours



Source: Ember Electricity Data Explorer, ember-climate.org



E.4 World energy supply and consumption is global production and preparation of fuel, generation of electricity, energy transport, and energy consumption. It is a basic part of economic activity. It includes heat, but not energy from food.

This article provides a brief description of energy supply and consumption, using statistics summarized in tables, of the countries and regions that produce and consume most.

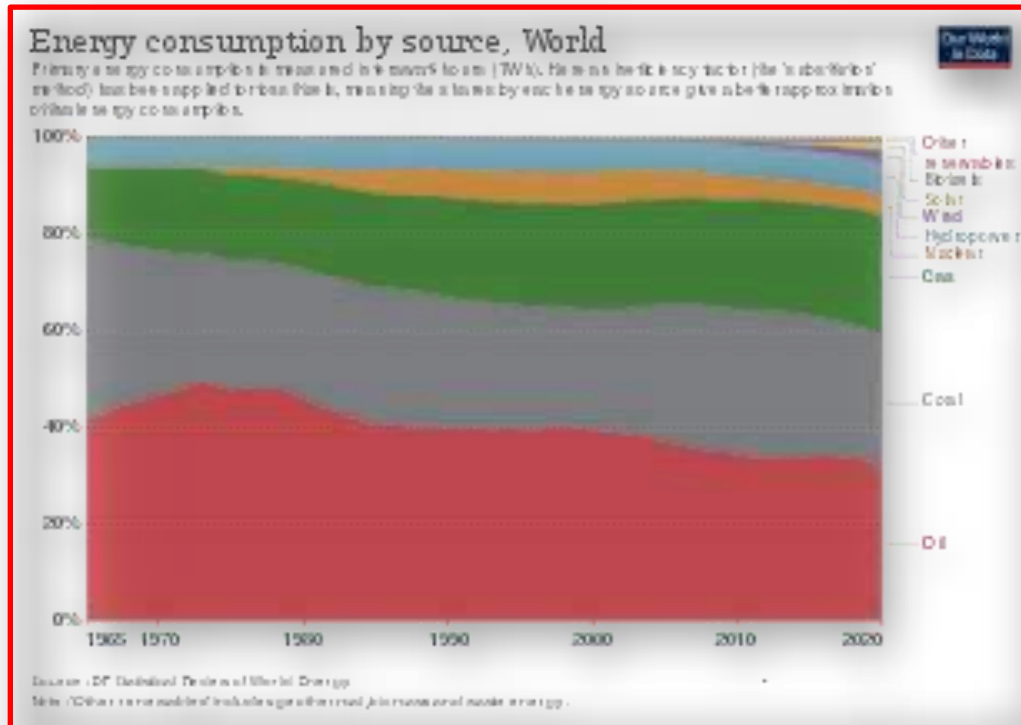
Energy production is 80% fossil, half of which is produced by China, the United States and the Arab states of the Persian Gulf. The Gulf States and Russia export most of their production, largely to the European Union and China, where not enough energy is produced to satisfy demand. Energy production is increasing 1 to 2% per year, except for solar and wind energy which averaged 20% per year in the 2010s.

World Wind and Solar power (GW)		
Year	Wind	Solar
2012	267	104
2015	416	228
2018	563	489
2021	825	849

Produced energy, for instance crude oil, is processed to make it suitable for consumption by end users. The supply chain between production and final consumption involves many conversion activities and much trade and transport among countries, causing a loss of one quarter of energy before it is consumed.

Energy consumption per person in North America is very high while in most of Africa it is low and more renewable. There was a significant decline in energy usage worldwide caused by the COVID-19 pandemic, especially in the iron and steel industry as demand for new construction shrank. An increase in the global demand for manufactured goods by the iron and steel industry, could increase consumption to levels similar to that in 2019.

Of about 50 billion tonnes worldwide annual total greenhouse gas emissions, 36 billion tonnes of carbon dioxide was emitted due to energy (almost all from fossil fuels) in 2021. The goal, set in the Paris Agreement to limit climate change, will not nearly be reached. Several scenarios to achieve the goal are developed.



This is the worldwide production of energy, extracted or captured directly from natural sources. In energy statistics primary energy (PE) refers to the first stage where energy enters the supply chain before any further conversion or transformation process.

Energy production is usually classified as:

- fossil, using coal, crude oil, and natural gas;
- nuclear, using uranium;
- renewable, using biomass, geothermal, hydropower, solar, tidal, wave, wind, and among others.

Primary energy assessment by IEA follows certain rules to ease measurement of different kinds of energy. These rules are controversial. Water and air flow energy that drives hydro and wind turbines, and sunlight that powers solar panels, are not taken as PE, which is set at the electric energy produced. But fossil and nuclear energy are set at the reaction heat, which is about three times the electric energy. This measurement difference can lead to underestimating the economic contribution of renewable energy.

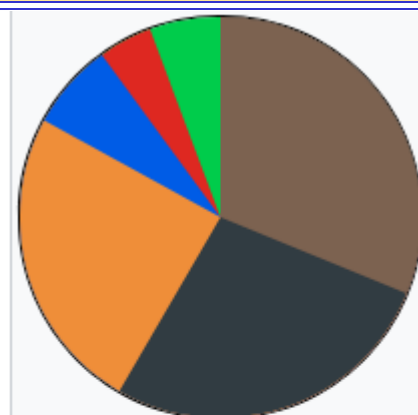
Enerdata displays:



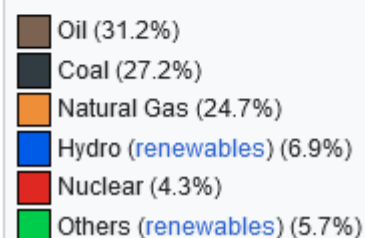
The table lists worldwide PE and the countries producing most (76%) of that in 2021, using Enerdata. The amounts are rounded and given in million tonnes of oil equivalent per year (1 Mtoe = 11.63 TWh, 1 TWh = 10⁹ kWh) and % of Total. Renewable is Biomass plus Heat plus renewable percentage of Electricity production (hydro, wind, solar). Nuclear is nonrenewable percentage of Electricity production. The above-mentioned underestimation of hydro, wind and solar energy, compared to nuclear and fossil energy, applies also to Enerdata.

- Total Energy / Production: Coal, Oil, Gas, Biomass, Heat and Electricity.
- Renewables / % In Electricity Production: Renewables, Non-Renewables.

Largest PE producers (76%)					
	Total	Coal	Oil & Gas	Renewable	Nuclear
China	2,950	71%	13%	10%	6%
United States	2,210	13%	69%	8%	10%
Russia	1,516	16%	78%	2%	4%
Saudi Arabia	610	0	100%	0	0
Iran	354	0	99%	0	1%
United Arab Emirates	218	0	99%	0	1%
India	615	50%	11%	33%	6%
Canada	536	5%	81%	10%	4%
Indonesia	451	69%	17%	14%	0
Australia	423	64%	33%	3%	0
Brazil	325	1%	55%	42%	2%
Nigeria	249	0	47%	53%	0
Algeria	150	0	100%	0	0
South Africa	151	91%	1%	8%	0
Norway	214	0	93%	7%	0
France	128	0	1%	34%	65%
Germany	102	27%	3%	47%	23%
World	14800	27%	53%	13%	7%



World total primary energy consumption by type in 2020^[15]



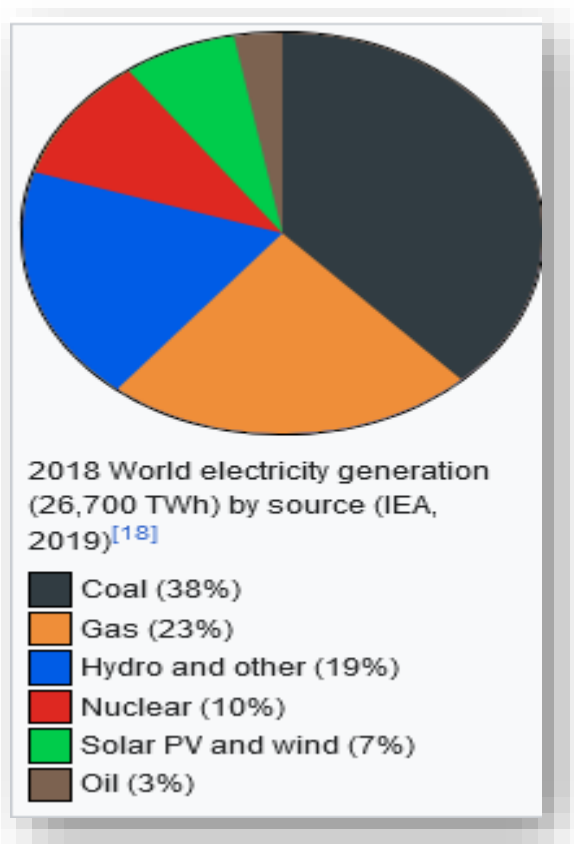
E.5 Energy conversion and trade

Primary energy sources are transformed by the energy sector to generate energy carriers.

Primary energy is converted in many ways to energy carriers, also known as secondary energy.



- Coal mainly goes to thermal power stations. Coke is derived by destructive distillation of bituminous coal.
- Crude oil goes mainly to oil refineries
- Natural-gas goes to natural-gas processing plants to remove contaminants such as water, carbon dioxide and hydrogen sulfide, and to adjust the heating value. It is used as fuel gas, also in thermal power stations.
- Nuclear reaction heat is used in thermal power stations.
- Biomass is used directly or converted to biofuel.



- Coal (38%)
- Gas (23%)
- Hydro and other (19%)
- Nuclear (10%)
- Solar PV and wind (7%)
- Oil (3%)

2018 World electricity generation (26,700 TWh) by source (IEA, 2019)



Nation	Export minus Import in 2021
Russia	682
Saudi Arabia	388
Australia	296
Canada	245
Indonesia	226
Norway	185
Italy	-114
Turkey	-118
Germany	-187
South Korea	-239
India	-323
Japan	-357
China	-803

Electricity generators are driven by

- steam or gas turbines in a thermal plant,
- or water turbines in a hydropower station,
- or wind turbines, usually in a wind farm.

The invention of the solar cell in 1954 started electricity generation by solar panels, connected to a power inverter. The mass production of around 2,000 panels made this economic.

Much primary and converted energy is traded among countries. The table lists countries with large difference of export and import in 2021, expressed in Mtoe. A negative value indicates that much energy import is needed for the economy. Russian gas exports were reduced a lot in 2022, as pipelines to Asia plus LNG export capacity is much less than the gas no longer sent to Europe.

Big transport goes by tanker ship, tank truck, LNG carrier, rail freight transport, pipeline and by electric power transmission.

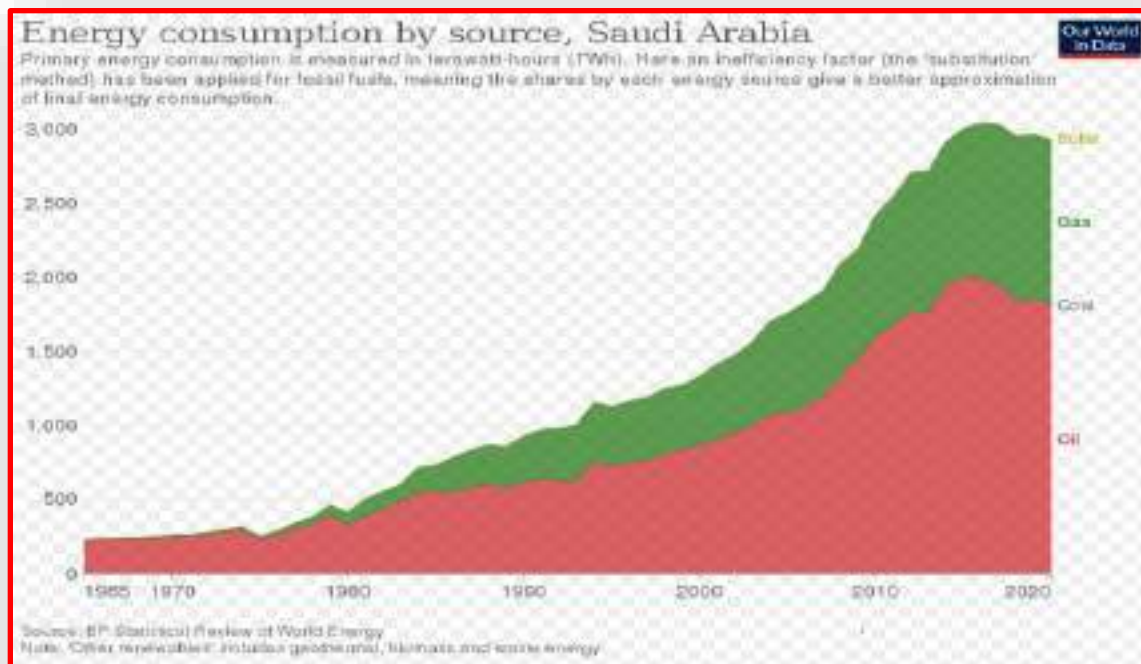
E.6 Energy in Saudi Arabia

This involves petroleum and natural gas production, consumption, and exports, and electricity production. Saudi Arabia is the world's leading oil producer and exporter. Saudi Arabia's economy is petroleum-based; oil accounts for 90% of the country's exports and nearly 75% of government revenue. The oil industry produces about 45% of Saudi Arabia's gross domestic product, against 40% from the private sector. Saudi Arabia has per capita GDP of \$20,700. The economy is still very dependent on oil despite diversification, in particular in the petrochemical sector.



For many years the Kingdom of Saudi Arabia has been the world's largest petroleum producer and exporter. In 2011 it pumped about 1.7142 million m³ (10.782 million bbl) per day of petroleum. While most of this is exported, domestic use is rapidly increasing, primarily for electricity production. Saudi Arabia also has the largest, or one of the largest, proven crude oil reserves (i.e. oil that is economically recoverable) in the world (18% of global reserves, over 41 billion m³ (260 billion bbl)). Saudi Arabia, has one of the largest reserves of natural gas in the Persian Gulf. Proven natural gas reserves are over 7 trillion m³ (44 trillion bbl). Global production in 2009 reached 4.6 billion m³ (29 billion bbl) of oil and 3 trillion cubic meters (110 trillion cubic feet) of natural gas. but due to its sizeable domestic gas markets, is "unlikely to become LNG exporters anytime soon". Saudi Arabia is prioritizing upstream gas investment, but for use in the domestic power generation market, not for export.

The country has had plans to diversify its energy sources for some time, developing solar and nuclear power.





Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.

Our World
in Data



Source: Global Carbon Project

Energy in Saudi Arabia

	Capita	Prim. energy	Production	Export	Electricity	CO ₂ -emission
	Million	TWh	TWh	TWh	TWh	Mt
2004	24.0	1,633	6,469	4,811	148	324
2007	24.2	1,748	6,412	4,606	175	358
2008	24.7	1,879	6,734	4,796	187	389
2009	25.4	1,836	6,145	4,324	199	410
2010	27.46	1,969	6,258	4,551	219	446
2012	28.08	2,176	6,998	4,700	227	457
2012R	28.29	2,329	7,269	4,949	248	459
2013	28.83	2,235	7,146	4,882	264	472
Change 2004–2010	15%	21%	-3%	-5%	48%	37%

Mtoe (million tonnes of oil equivalent) = 11.63 TWh (terawatt-hours).

Primary energy includes energy losses.

2012R: CO₂ calculation criteria changed; numbers updated.



The desert-covered Kingdom of Saudi Arabia is the geographically largest country in the Middle East. Moreover, it accounts for 65% of the overall population of the GCC countries and 42% of its GDP. Saudi Arabia does not have a strong history in environmentalism. Thus, as the number of population increases and the industrial activity grows, environmental issues pose a real challenge to the country. Lack of environmental policy can be linked to an enormous reliance on oil. Due to intense fossil fuel usage, Saudi Arabia has generated a number of environmental issues. Urbanization and high standards of living contribute to ground, water, and air pollution. Agriculture and overconsumption of natural resources cause deforestation and desertification.

Likewise, Saudi Arabia's oil industry subsidizes energy use and magnifies carbon dioxide emissions. These environmental issues cause a variety of health problems including asthma and cancer. Some environmental action is taking place such as the construction of a renewable energy industry. Policies and programs are also being developed to ensure environmental sustainability.

Saudi Arabia contains the largest known oil reserve. This generates an abundance of wealth for the country and places it as the number one oil exporter in the world. Oil extraction is a priority over environmental policy. While oil is not environmentally sustainable, Saudi Arabia has made some contributions to fighting climate change. The kingdom implemented its first environmental law in 1992, the Presidency of Meteorology and Environmental Protection Act. This measure was enacted to encourage environmental awareness and sustainable law creation. Moreover, Saudi Arabia and other Arab nations are working together to create a series of international environmental contracts. Saudi Arabia alone has signed eighteen pacts and ratified thirty-nine environmental agreements.^[4] Saudi Arabia's environmental performance index (EPI) is 55.3. The EPI is an internationally standardized scale, with 1 as the lowest environmental performance and 100 as the highest. The scale measures both environmental health and ecosystem viability. Out of Middle Eastern countries, Saudi Arabia ranks 9th on the EPI.

E-7 Project objectives

AR-SIPVPP, a Solar Power Plant to be located in the North Eastern Province, will have a Ar Rass Solar PV Park (hereinafter “the Project”) is located approximately 3 km south of Ar Rass Town in Riyadh Province. The total area of the project is about 30.0 km². The proposed Project will utilize and operate five (5) solar generating units (SGUs) and five (5) substation. The initial power generation capacity will be approximately 1,440 MW and is expected to produce 4,533 GWh per ye



ar. This yearly production will supply energy to 180,000 households and reduce the emission of greenhouse gases by 3.6 million tons of CO₂ equivalent

E-8 Disciplines Scoped into the ESIA

Based on the outcomes of the Scoping process, and Information furnished by M/S ACWA Power Company (Saudi Listed Joint Stock Company), and Environmental Balance Company's (EBC) Project understanding and considerations of potential impacts and effects, the technical disciplines that are scoped-in for consideration during the ESIA are summarized below.

Discipline	Scoped In (Yes/No)	Justification
Climate	No	AR-SIPVPP construction Works activities will be undertaken over a short period and the associated GHG emissions are not of a scale that is considered to have the potential to result in a significant effect on climate. However, the contractor has a Policy to reduce the GHG emissions during construction.
Air quality	Yes	Generation of dust and emissions during AR-SIPVPP construction works has the potential to affect the workforce. Operation of construction machineries such as excavators, barges, dredgers, vessels compressors and generators and the daily vehicle movements that will be required to transport the construction workers during AR-SIPVPP construction Works has the potential to result in significant effects for the AR-SIPVPP's community in the area.
Sound	Yes	Operation of construction machineries such as excavators, barges, dredgers, vessels compressors and generators and the daily vehicle movements that will be required to transport the construction workers during AR-SIPVPP construction works has the potential to result in significant effects.
Geology and Soils	Yes	Some ground stability concerns for the AR-SIPVPP construction works where identified and if not managed appropriately could result in significant effects.
Topography	No	Excavation, infilling and sea bed trenching for intake and out fall pipes will be undertaken which will not change the topography of the area. There are no on shore construction works involved
Groundwater	Yes	Potential impacts to groundwater by creating preferential pathways for contaminants, through modifying the discharges and recharges to the groundwater require assessment.
Terrestrial ecology	Yes	Site clearance activities will not cause loss of habitats and vegetation, there is no impact on flora is anticipated and if not managed properly could harm fauna.
Social	Yes	AR-SIPVPP construction Works will result in employment opportunities, as well as an influx of people into the area which would change the socio-economic status of the area and could lead to pressure on local services/resources, conflict and competition with the incumbent population.



Waste management	Yes	It is anticipated that solid and liquid waste will be generated during AR-SIPVPP construction Works, which if not appropriately managed have the potential to result in significant effects.
Archaeology and cultural heritage	Yes	AR-SIPVPP construction Works may have direct physical impacts on Archaeological remains and could lead to significant effects if not managed appropriately.
Landscape and Visual	Yes	Landscape effects associated with the Project would relate to changes to the, character and quality of the landscape resource, and how it is experienced. However, it is confined only to construction duration

Table E-2 :-Summary of significant impacts and proposed mitigation measures

Activity causing impact	Predicted Impact	Significance	Proposed Mitigation and Enhancement Measures	Residual Impact Significance
Trenching for laying of Foundation	Water contamination during stockpiling of excavated material	Substantial	• Method of Excavation	Negligible
			• Daily and monthly Environmental Monitoring	
			• Sampling of soil at the excavated material to determine compliance with the NCEC standards before and during excavation	
			• Excavation at the excavation site to determine compliance with the NCEC standards before and during excavation	
			• Apply Construction environmental management and Monitoring plan (CEMP)	
			• Ensure that all necessary permits prior to excavation and filling works has been acquired by contractor	
	Impact of noise from equipment	Negligible	• High maintenance standard of equipment	Negligible
			• Installation of noise suppressors in all the equipment	
			• Provision of silencer and muffler	
			• Limit the hours of operation	
	Air contaminants due to transporting and disposal of materials	Moderate	• Apply health and safety and environment manual (HSE)	Negligible
			• Watering of pavement to minimize dust	
			• Use of Personal Protective Equipment (PPE) as per health & safety guidelines	



Activity causing impact	Predicted Impact	Significance	Proposed Mitigation and Enhancement Measures	Residual Impact Significance
	Potential over-spill	Negligible	• Limit the capacity to avoid overloading • Good housekeeping • Use of well-maintained barge • Daily monitoring and inspection	Minor
	Workplace hazard	Negligible	• Good housekeeping • Applying and enforcing the company's HSE system • Safe operation through the use of safety management • system, protective equipment daily site inspection and safety training	Negligible
	Socio-economic development	Negligible	• Local Saudi companies should be contracted to supply construction and operation goods and services wherever practicable. • Economic impacts of AR-SIPVPP operations are characterized by AR-SIPVPP 's direct impact—that is, the number of jobs and labour income that are directly related to the AR-SIPVPP and its operations—and its employment and labour income multiplier effects.	Positive Impact
	Waste	Negligible	• AR-SIPVPP Waste Management Plan	Minor

E-9 Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass construction Works Overview

The scope of this proposal includes the design, engineering, procurement, manufacture, testing at the manufacturer works, supply, construction, erection, site testing and commissioning, performance and reliability confirmation, warranty confirmation, ownership, operation and maintenance of a high efficiency Solar Independent PV Power Plant technology. The project includes as part of ACWA Power's scope of work the Energy generation and storage.



Figure E-3– Allocated land area for Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass

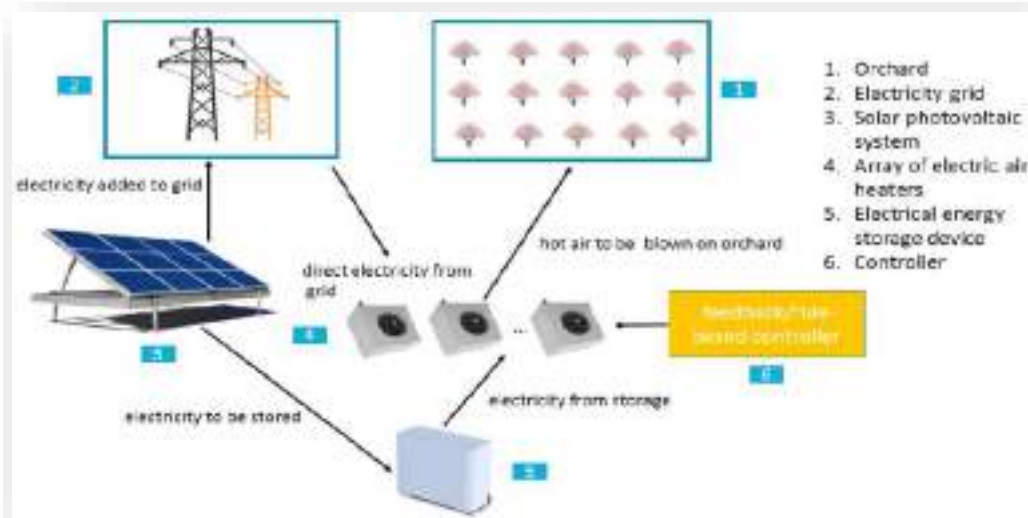


Figure E-4 – Components of AR-SIPVPP



E-10 Project Alternatives

If no AR-SIPVPP development occur there will be increased stress on the existing Power Plants due to progressive increased demand of electricity within the cities and villages Kingdom areas which is likely to create huge problems in KSA. AR-SIPVPP Project aims to conserve and protect the areas natural beauty through sustainable development mechanism and as result contributing to the realization of the Vision 2030. As such a ‘No Project Alternative’ option would not be in line with country’s vision.

E-11 Description of the Environment

Air Quality

Background air quality monitoring data, was collected in March 2023 within the Project site and a reference location. The conditions can be generally described as follows:

- SO₂, H₂S, CO, NO_x, O₃ and PM₁₀ concentrations were all low with an average well within the air quality standards. The main sources of emission in and around the project area are from vehicles movement, and the traffic near by the AR-SIPVPP area.
- Monitored daily maximum PM₁₀ concentration were below the daily and annual average air quality standards, because of all the area is covered with asphalt and yards are covered with concrete.

Noise

Given the Urban nature of the Project area in KSA, there are notable sources of anthropogenic sound such as industrial facilities, busy traffic routes, or ports were identified. The main sound sources at the locations of AR-SIPVPP construction works activities are therefore considered to be natural and anthropogenic noise generation.

Geology & Soils

The predominant landforms at the proposed AR-SIPVPP Project area could be Categorized as follows:

- Mud Flats
- Rocky area
- Red Soil

The Project area Soils and Geology is presented in detail in Section 5.0 Environmental Baseline of AR-SIPVPP Project

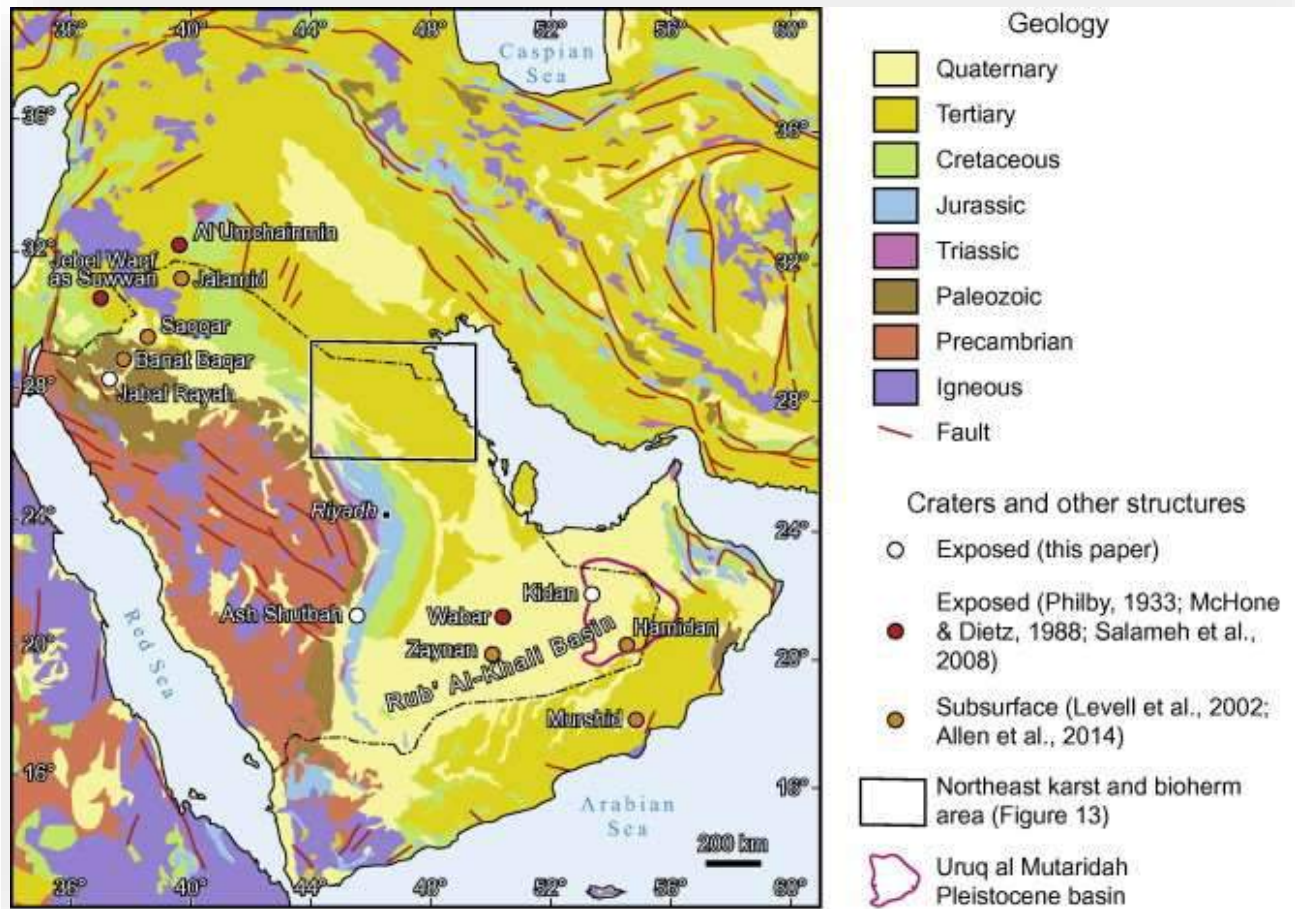


Figure : Geologic Map of Arabian Peninsula

Hydrogeology

A hydrogeological and hydro chemical study showed that a shallow alluvial aquifer, in eastern Saudi Arabia to assess the influence of protection measures on groundwater quality. The hydrochemistry was assessed up-gradient and down-gradient from potential contamination sources in the main city in dry and wet seasons prior to and after the installation of major drainage and wastewater facilities.

Groundwater

Renewable groundwater

Most of the runoff infiltrates the ground to recharge the shallow aquifers located along the valleys and beneath the alluvial fans and plains in various areas. These aquifers are generally unconfined, small in size and have water tables that respond rapidly to local precipitation. Some shallow aquifers are Khuf, Tuwail, Aruma, Jauf, Sakaka, Jilh and Jubaylah. The total renewable groundwater is estimated to be 2.8 BCM/yr



Non-renewable groundwater

Groundwater in the deep sandstone aquifers is non-renewable or 'fossil' water, which is confined in sand and limestone formations of a thickness of about 300 metres at a depth of 150-1,500 metres. The deep rock aquifers are sedimentary in origin, usually sandstone and limestone, extending over thousands of square kilo metres with poor natural recharge. Among these aquifers, Saq, Wajid, Tabuk, Minjur-Dhurma, Wasia-Biyadh, Umm er Radhuma and Dammam-Neogene are the principal aquifers. Map 1 illustrates the location of the principal aquifers.

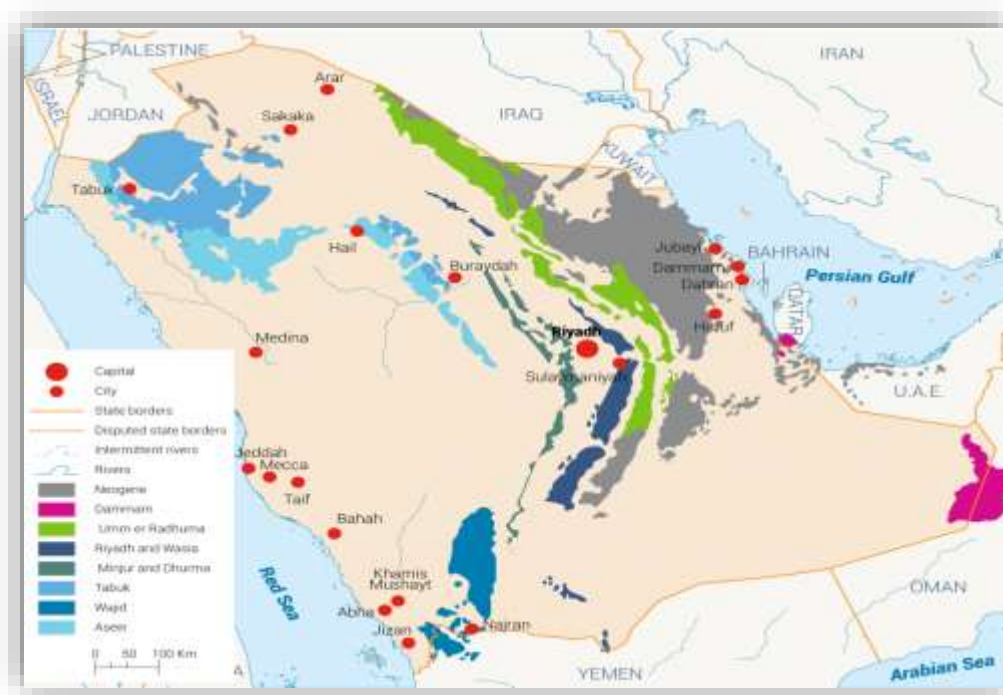


Figure : Hydrogeology Map of Arabian Peninsula

Terrestrial Ecology

Fauna

As the area is currently undeveloped and planned to build solar PV and moderate ecologically disturbed due to the ongoing anthropogenic activities, there is no major flora and faunal occurrence was found in the area. The presence of animal burrows indicates reptile activity in the area, but only lizards and insects were observed. It seems that animals have migrated from this area.

Flora



There is sparse vegetation found at AR-SIPVPP. The existing plant communities observed near AR-SIPVPP Project area during Terrestrial Ecological survey are presented in section 4.0. Only few small herbs were found.

Social

Socio Economic Effects Assessment

In order to assess the potential social and economic impact due to the construction and operational phases of AR-SIPVPP Project, the following monitoring and survey activities are conducted during the study period.

Assessment of Project skill requirement in relation to Local Skill Availability

AR-SIPVPP Project will generate employment opportunities that will influence territorial and local labour market. To fulfill the possible demands of labour and suppliers the surrounding territorial area will respond. From socio-economic point of view this is a positive improvement of social as well as labour market.

Employment and Regional Economic Effects

AR-SIPVPP Project will generate a number of job scopes as well as the economic activities that will increase people's procurement power. The local and regional demand and supply will get forces. The employment opportunities from the AR-SIPVPP Project will influence territorial and local labour market. To fulfill the possible demands of labour and suppliers of goods and services the surrounding territorial area will respond. Due to water supply scarcity, new settlement and industries in the region will increase gradually. The positive social and economic impact is expected from the AR-SIPVPP Project establishment.

Demography

AR-SIPVPP Project will generate attractive economic benefits that will affect community populations. It is expected that existing birth and death rates will be improved due to improvement of infrastructures and healthcare provider. All aspects of the project will create demands for labour and local business opportunities, and thus tend to encourage migration to regional and other centers of business activity.

Residential

AR-SIPVPP Project effects on housing and accommodation will include direct and indirect demands for short- and long-term accommodation. There is no short-term accommodation effect because the project is providing housing for its employees. However, effects on housing are expected to be



adverse in the Ar Rass area because of less housing is available there. Table below shows expected housing effects. These effects are expected to be low magnitude, because it is expected that the local housing business sectors will generate sufficient quantity of housing facilities.

Summary

A summary of the key impacts, associated with social and economy for the AR-SIPVPP Project are provided in below. The potential overall impact includes impacts that would arise in the construction phase and in the operational phase of the AR-SIPVPP.

Potential Impact	Nature of Impact (Permanent or Temporary) (Direct or Indirect)	Significance (Major, Moderate or Minor) (Positive or Negative)	Mitigation / Enhancement Measures
During the construction and operational phase of the AR-SIPVPP Project is likely to benefit the local economy in terms of the provision of water supply to the Ar Rass area	Permanent	Major Positive	• No Mitigation Measures Required
The potential impacts from the presence of worker, like housing pressure on local area, and resources.	Temporary	Minor Negative	• The assessment has identified the lack of local provisions, in the form of housing, school facilities, because work force which are likely to have families. • It is expected the housing provision for the area will be solved by local business immediately.
The potential impact of the AR-SIPVPP Project operations on social health and safety (Ships Idle)	Temporary	Minor Negative	• the implementation of appropriate measures as part of the Health, Safety and Environment Management Plan during the operational phase of the AR-SIPVPP plant will ensure that occupational health and safety risks are minimised
Noise	Temporary, Direct	Minor Negative	• Application of best practicable means

Waste

KSA generates between 1-1.49kg/capita/day of solid waste (World Bank, 2019a). There are currently solid or liquid waste facilities at the AR-SIPVPP Development site and Collection and Transport waste facilities available in the area.

Waste Source	Actions to Minimize Waste
Design	Designers and customers encouraged to use standard product dimensions (e.g., 600- or 1200-mm increments, standard door and window sizes and prefabricated products)



	Prefabricated products used as much as possible to reduce onsite handling, reworking and offcuts.
	Untreated timber specified in all applications where this is allowed to encourage future recycling and lower environmental impact
	Detailed plans and instructions provided to estimators, workers and contractors to improve accuracy of material takeoffs and avoid reworking.
Material Selection	Materials are selected based on affordability, durability, low maintenance and low environmental impact (including being recyclable or including recycled content)
Material Estimates	Waste allowances for material quantities reviewed and minimized
	Credits requested from suppliers for unused products in good condition.
Delivery & Storage	Deliveries scheduled on a 'just in time' basis where practical to avoid onsite storage and damage
	Products susceptible to onsite damage to be stored securely and covered where necessary
Unauthorized Dumping	Skips on site only when absolutely necessary
	Waste bins kept away from public view and access whenever possible
	Lockable skip bins used on site
	Recycling sign prominently displayed on site using recycling symbol and stating 'We are recycling on this site. NO UNAUTHORIZED DUMPING' or similar
General Waste	Incentives in place for workers and subcontractors to achieve SWMP targets
	Excess materials stored for re-use on future projects
	Valuable or useful excess materials such as paint, floor coverings, fixtures and fittings neatly stored for the homeowner's future use.
	Excess re-usable product can be sold on Trade me or the Waste Exchange
	A dedicated rubbish bin or bag is provided for workers lunch wrappers, food scraps etc. to avoid skip contamination and a domestic recycling bin for bottles, cans, newspapers, magazines etc.
	Waste is compacted, flat stacked as much as possible to reduce volume in waste skips.
	Waste materials sorted onsite for possible re-use and recycling using a fenced off designated waste storage area. This avoids a skip on site until absolutely necessary. Suggested re-use and recycling piles in the order they normally occur are: concrete & masonry, steel, timber products, plastics, insulation, plasterboard, paint tins and cardboard.
Waste Management Knowledge	Site waste management plan distributed to all workers and subcontractors as part of tender document, contracts and site induction prior to commencing work onsite.
	Progress towards SWMP targets communicated to relevant site visitors, workers and subcontractors.
Waste Disposal Services	Only preferred waste collection and recycling operators to be used for project waste disposal services (See preferred waste operators attached)



Plasterboard	Plasterboard waste must be sorted, covered or stored in a sheltered place such as the garage until collection.
	<i>Onsite recycling</i> - For onsite disposal use clean unpainted standard plasterboard only (excluding wet area board and bracing board which may contain wax or fiberglass additives). Pulverize to pieces smaller than 2cm diameter and place below topsoil to accelerate the breakdown of the product. Spread evenly and apply at a rate of up to 5kg per square meter (standard sheet is approx. 20kg). Avoid wet areas as prolonged anaerobic conditions can cause possible sulfide gas formation. Check compliance with the local territorial authority beforehand.
	<i>Waste deferral</i> - clean offcuts can be placed within internal wall spaces, providing the opportunity to recycle them at the end of the homes useful life and also some noise dampening qualities. Offcuts should be cut down or scored and folded 'concertina' style up to four sheets maximum to allow for future wiring. Care must be taken to select wall cavities without insulation, wiring, plumbing or HVAC ducts such as wardrobes, hot water cupboards, stairwells or garages. Place pieces securely to avoid rattling and consider the sequence of lining rooms to ensure vacant walls are available as each room is completed.
Timber - Untreated	Sorted onsite and re-used where possible
	Sorted offsite and recycled where possible
Timber – Treated or Engineered	Sorted onsite and re-used where possible
Concrete & Masonry	Small quantities of inert concrete & masonry waste to be used on site for landscaping, backfill, under walkways or driveways.
	A hard fill skip is to be used so concrete & masonry can be recycled
Packaging	Suppliers asked to limit packaging.
	Suppliers to unpack materials and take back as much packaging as possible for recycling.
	Where domestic recycling operates in the area, cardboard is stacked on the kerbside ready for collection or dropped off at local recycling depots.
Metals	If quantities sufficient, metal waste is to be sorted on site and sold to a local scrap metal operation.
	Skip company to collect mixed waste skip and sort any metal offsite for recycling.
Insulation	Excess insulation to be carefully placed in the ceiling space, especially at perimeters or any vacant wall cavities or gaps.
	Larger polystyrene sheets to be used under concrete floors and driveways or as a protective lining behind retaining walls or underground walls.
	Installers are to remove all surplus insulation for re-use and/or recycling.
Hazardous	Paints, stains, solvents, adhesives, sealants, treatments etc. are to be collected for re-use on further projects
	Excess paint and stain can be recycled. Contact supplier for options or use paint wise recycling program
	Water runoff from sediment, unset concrete etc. should be diverted from waterways and storm water drains and allowed to settle onsite (if necessary,



	use channels or collection ponds, hay bales, filter fabrics etc. to help filter and settle any runoff).
	Hazardous substances such as liquid paints, stains, timber treatments, and solvents contained carefully onsite and disposed of correctly.
	Paint contractors to provide proof of proper waste disposal.
	Benign paints, stains, caulks and solvents used where possible to minimize hazardous wastes.
	Hazardous waste disposal operators listed on this SWMP.

Archaeology

During the surveys undertaken in March 2023 archaeological and cultural heritage sites near to the AR-SIPVPP site were recorded. But these are located far away from AR-SIPVPP Project. No impacts are anticipated.

Landscape & Visual Amenity

The landscape will not be impacted due to AR-SIPVPP construction works. But the cranes, construction equipment, will affect the land scape which is temporary in nature.

Potential Impacts

Climate Change

Due to the short duration nature of activities associated with the AR-SIPVPP construction works and the associated GHG emissions have a moderate at a scale considered to have a significant effect on climate.

Air quality

Emissions from onsite and offsite construction plant and vehicles: Onsite plant and vehicles and offsite vehicles will generate emissions of NO_x/NO₂, PM₁₀, PM_{2.5}, SO₂, CO and VOCs within the vicinity of the AR-SIPVPP Construction site. Currently the air quality is fine and requires regular monitoring during the construction duration.

Noise

Predicted construction noise levels are below 44 dB LAeq, 1h at all receptors, which is considered negligible impact during both daytime, evening and night-time periods. AR-SIPVPP construction s programmed is envisaged to be 20 months and as such any noise impacts might not be significant, be of a temporary nature and have no lasting residual impact. No additional noise mitigation measures are considered to be required. Construction traffic movements within AR-SIPVPP and nearby Hail Highway which is far and AR-SIPVPP center roads, when in close vicinity to a receptor, has the potential to cause temporary disturbance while it is passing by. It is therefore important that the routing and timing of vehicle movements is carefully managed. However, any increases in road traffic



noise levels during AR-SIPVPP construction will be temporary, short term, and although the effect will be dependent on the actual number of traffic movements, it is considered that adverse effects can be managed and avoided. The equipment should be maintained properly and adhere to KSA –NCEC standards

Geology

Both, construction and operational phases impacts of the project were assessed as a negligible effect. For the Project the vast majority of the potential residual effects identified for soils and geology, if realized, would occur at discrete locations and not continually or extensively across the AR-SIPVPP Project and are therefore unlikely to have an overlapping zone of influences.

Hydrology

In general, the significance of residual flood risk related impacts is negligible. Cumulative impacts on the storm water systems might occur if more than one rainfall event occurs within a short timeframe or if regular maintenance procedures are not conducted adequately. In general, the significance of residual impacts caused by water utilities impacts is negligible. Storm water discharge is infrequent and for a limited duration. The impact would be local and not very severe; however, impacts could have a lasting effect.

Hydrogeology

Impacts to regional groundwater resources, local groundwater level and flow, groundwater quality and human health considered as negligible given the depth to groundwater, poor groundwater quality and low recharge levels, designed spill mitigation and lack of groundwater users in the area.

Terrestrial Ecology

There are no ecologically important habitats within the AR-SIPVPP site boundaries which may be directly or indirectly impacted by the proposed AR-SIPVPP construction works. The mitigation measures during construction will include translocation of any fauna encountered and control of light and noise impacts to sensitive habitats for fauna.

Social

Socio-economic benefits of the project to the region are good at this AR-SIPVPP Construction stage which provide benefits from employment opportunities and improved infrastructure opening further opportunities for increased capital expenditure and associated economic effects. With employment opportunities attracting workforces from other parts of KSA and beyond brings with a range of potentially negative impacts as well as general disturbance and disruptions to movement patterns.



The project is located in an isolated area designated for AR-SIPVPP only for where there are no communities existed. There is no requirement of resettlement.

Waste

Given the commitments to minimize, reuse and recycle the demand on existing waste management infrastructure is considered negligible. Detailed and specific controls on waste separation and storage need to be included in the specifications for all contractors and monitored throughout construction to ensure targets are met. Spoil material from excavation will be used for fill and it is expected a deficit of material is likely through further phases of the project. Spoil areas will require specific management procedures to ensure wind erosion is limited.

Flood risks:

The history of flood events reveals that there were no flood events in the proposed AR-SIPVPP area. However, ACWA Power Company (Saudi Listed Joint Stock Company) /the EPC contractor has to prepare a Flood Risk Assessment Study /Storm Water Management plan before the construction works and implement it during Construction and Operation.

Archaeology

It is not expected that any superficial or buried archaeological sites within the study area which classed according to IFC criteria as ‘replicable cultural heritage’ (IFC, 2012), If found during construction it can be mitigated by appropriate archaeological investigation, recording and dissemination undertaken in line with national guidance and international best practice. This should be agreed in discussion with and approved by, Saudi Commission for Tourism and National Heritage, as well as other relevant stakeholders in advance of construction, work being undertaken.

Landscape and visual

Views from Highways towards the Project activities would be partially screened and restricted by intervening scenic views within the expansive views. On balance it is considered that the magnitude of change on users of Four Highways would be of low significance, and minor.

Cumulative Impact

AR-SIPVPP Impact assessment spatial and temporal scope is limited to a short period of low impacts terrestrial temporary construction works only. Given this, it is not anticipated that any significant cumulative impacts would occur during this period.

Mitigation

A number of key mitigation measures are prescribed in this study that allows the residual risks to be



minimized to a large extent. These mitigation measures are transcribed to the CESMP and monitoring throughout the AR-SIPVPP construction Works is required to determine the effectiveness of these measures to achieve the necessary Project targets.

Stakeholder Engagement

Stakeholder engagement that has occurred to date is presented in this ESIA process, between EBC, M/S ACWA Power Company (Saudi Listed Joint Stock Company) /the EPC contractor and respective stakeholder groups.

ESIA process stakeholder engagement has many benefits as it allows transparency in decision-making, good relations with host communities and it often builds a positive reputation for the developer nationally and potentially internationally.

- Ministry of Environment Water and Agriculture (MEWA)
- Ministry of Transport
- Ministry of Finance
- Municipality of Riyadh / Hail
- NCWCD/National Center for Wild life
- NCEC
- Saudi Geological Survey
- Ministry of Interior
- Saudi Commission for Tourism and National Heritage (SCTH)

Conclusion

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Construction works by nature are limited in temporal and spatial scope. Key impacts result from on shore Environment, natural habitat areas, Air, Noise ground water Quality. With the appropriate presented measures in place, these impacts can be adequately mitigated or offset. Careful consideration in terms of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP)/–EPC contractor M/S ACWA Power Company (Saudi Listed Joint Stock Company) /the EPC contractor site management and practices will ensure these receptors are protected. Specific site training and Tool Box Talks by competent experts will be needed. This forms a key part of the Framework CESMP.

Although setbacks are in place, these are largely for design. Appropriate measures will need to consider for noise and light spill impacts on terrestrial Environment. It is recommended that a



terrestrial ecologist is consulted in the development of the associated construction management plans for these issues. Consultation with the SCTH should be taken place and further consultation is needed to agree and define measures to mitigate and manage potential archaeological features of the project. The project entails numerous positive impact benefits which include the socio-economic through alignment with national and regional development plans (Vision 2030) general investment, employment and environmental conservation.

Recommendations

Suspended Particles are likely to be released into the air during the excavation, piling, site clearing, leveling, grading etc. and stockpiling of excavated material until completion of foundation. These will be transported by the air and makes dust in air.

1. Air Pollution
2. Noise and Vibration
3. Soil pollution
4. Ground water contamination
5. Terrestrial ecology: Loss of habitat

The above issues have to be controlled to mitigate their effects by implementing the CESMP

An Environmental Team from M/S ACWA Power Company (Saudi Listed Joint Stock Company) Saudi Arabia shall be employed to carry out the monitoring and audit works. M/S ACWA Power Company (Saudi Listed Joint Stock Company) Environmental Team will:

- Undertake an Environmental Monitoring programme during the construction phase of the Project;
- A third party independent Environmental Consultant should be appointed to conduct Environmental Audit
- Carry out regular environmental monitoring and audits, and ensure that environmental mitigation measures recommended in the Contract Specifications are enforced;
- Implement corrective actions and other mitigation measures to reduce impacts where environmental non-compliance findings are identified in the course of the regular EM&A and other inspections; and,
- Preparing monthly environmental monitoring and audit report and submission to NCEC to obtain their approval.



In accordance with the requirements of the project monthly report, water quality sampling stations have been established around the AR-SIPVPP areas. The frequency of the routine Air Quality, Noise, Flora and Fauna monitoring will depend upon the site activities, environmental variations and the requirements of NCEC during the construction period. However, it will be at least once a week in the beginning. Measurements should be taken using a portable, equipment. NCEC certified laboratory should be employed for full suite of physical-chemical and biological analysis. The analytical methods shall be explained through the reporting procedure and each sample shall have a chain of custody that shall be available for auditing purposes should the need arise.

Environmental Monitoring during construction phase of AR-SIPVPP works

To accumulate relevant data during construction of AR-SIPVPP and Saudi Arabia 's Environmental Consultant and their environmental staff shall witness such activities and record the data by using "Environmental Monitoring Report". This collected information shall be used to create an overall Monthly Environmental Report that will be produced by ACWA Power Company (Saudi Listed Joint Stock Company)'s Environmental Consultant and submitted to NCEC for their review and approval.

NCEC CHECKLIST ESIA OF AR RASS SOLAR INDEPENDENT PV POWER PLANT (AR-SIPVPP), –APPENDIX 2.4 OF GERRI

Section	Requirement	Section
1	<i>Presentation of the Project</i>	1
2	<i>Description of the Project and its Objectives</i>	3
	Goals	3
	Need for the Project	3
	Components of the Project	3
	Project Construction Phases	3
	Workforce Required for Implementation of the Project (Construction)	3
	Workforce Required for Implementation of the Project (Operations)	3
	Alternatives and Options	6
3	<i>Status of Surrounding Environment</i>	4
	Air Quality	4
	Soil and Topography	4
	Oceanography	4
	Surface and ground water	4
	Land Environment (fauna/flora)	4
	Marine Environment (fauna/flora)	4
	Land use of selected site and its surroundings	5
	Land Ownership	4
4	<i>Environmental Assessment</i>	5
	Identification of general potential impacts of the project and suggested	5
	Identification and analysis of key effects of the project on:	5



	➤ Air Quality	5
	➤ Marine and Coastal Environment	-----
	➤ Surface and underground water	5
	➤ Flora and fauna	5
	➤ Land use and urban development	5
	➤ Residential clusters	5
	➤ General Scenic view	5
	➤ Others	5
	Greenhouse Gases	5
	Human Health	5
	Cumulative Impact	5
5	Assessment of Significant Impacts	7
	Quantify and rate the significant impacts on natural resources	7
	Estimate the relative damage to the area and the extent of its	7
	Estimated lifespan of the facilities	7
	Studies on the possible mitigation of the anticipated impacts	7
6	Summary of the Significant Impacts After Mitigation	7&10



SECTION 1.0 INTRODUCTION AND OVERVIEW



SECTION 1.0 INTRODUCTION AND OVERVIEW

1.1 Background

The Environmental and Social Impact Assessment (ESIA) study for Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project has been presented in compliance with the Appendix 2.4 of General Environmental Regulations and Rules for Implementation (GERRI, 2001) of NCEC-KSA and Equator Principles 2020 -ESIA Guidelines. The environmental assessment study assures compliance with the regulatory requirements; identifies and analyzes sensitive components of the existing environment; determines the type, nature and importance of the probable environmental impacts during construction; identifies and recommends practical effective mitigation measures; recommends a framework for an environmental management and monitoring plan for the construction and operation of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project; and ensures that all stakeholders deemed to be influenced by the projects or activities are fully considered. M/S ACWA Power Company (Saudi Listed Joint Stock Company), Saudi Arabia have commissioned the Environmental Balance Company to undertake an Environmental and Social Impact Assessment (ESIA) Study for Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass.

In conformity with Appendix 2.4 of GER-/NCEC and Equator Principles July 2020 ESIA Procedure; this project has been classified as category III and hence requires a comprehensive Environmental and Social Impact Assessment (ESIA) prior to commencement of the project execution. The main objective of this ESIA is to assess in advance the impacts from the construction and operation phases of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project and to identify mitigation and control measures.

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass ‘the scope of work is presented in Section 3 – Project Description

It should be noted that the ESIA has been prepared based on the available approved drawings and master plan supplemented with design and construction information provided by M/S ACWA Power Company (Saudi Listed Joint Stock Company).

1.2 Project Overview

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass plant site

The project is located in the North Eastern Province of Saudi Arabia. Ar Rass Solar PV Park (hereinafter “the Project”) is located approximately 24 km south-east of the city of Ar Rass in Riyadh Province. The location is an undeveloped and unfenced area of approximately 57.6 km².



The Project location is shown in Figure 1-1; whereas, Figure 3-1 shows the Project general layout (a higher resolution figure is presented in Appendix C) and Table 3-1 presents the coordinates of the site boundaries.

Table 3-1 Project Site Coordinates (WGS84 zone 38N)

Point	Easting	Northing
Pto-1	43.57155	25.61813
Pto-2	43.62129	25.61861
Pto-3	43.72329	25.62339
Pto-4	43.71212	25.59529
Pto-5	43.62175	25.57889
Pto-6	43.57202	25.57841

Project Details

The Project installed capacity is 2,620 MW which is equivalent to generating approximately 7,006 GWh per year. It should be noted that this capacity is the initially estimated capacity and should be confirmed or updated, as necessary as part of the detailed design of the Project.

The total number of SGUs is eight (8). The capacity of the SGUs will be between 120-700 MW; one small unit with capacity 120 MW, six SGU have a capacity 300 MW and one (1) larger unit with capacity 700 MW., and each will have a dedicated 33/132 kV step-up substation (SGUS) that will connect to a central 132/380kV Switching Substation (SS) where it will collect the energy evacuated from SGUSs

1.2.1 Legal and Policy Framework

This Environmental and Social Impact Assessment (ESIA) study has been prepared within the regulatory provisions of the NCEC, Equator Principles July 2020 (IFC Standards/2012). Further, this ESIA has been carried out in fulfillment of the General Authority of Meteorology and Environmental Protection (GAMEP) which is now renamed as National Center for Environmental Compliance (NCEC) commitment to environmental protection as stated in their respective policies and standards. From the comprehensive Environmental and Social impact assessment, it is concluded that the Construction and operation of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass will not lead to significant impacts on various environmental components after the recommended mitigation measures are implemented. The most significant impacts will occur excavation of the soil for foundation for Project facilities. These are anticipated to be short-term temporary and, providing



full mitigation is applied, the baseline condition will have largely returned to the predevelopment conditions after a very short period.

The Construction and operation of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project is expected to commence excavation and initial site clearing up to foundation works which the impacts which are limited to the project site and adjacent areas. The impact mitigation from transmission lines (OHTL) and substations to be achieved for protection of the environment in the best possible way.

1.3 Need for Development

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP); The Substations, both the SS and SGUSs, will be Gas Insulated Substation type. Each SGUs will be connected to the SS through a 132 Kv Double circuit over-head line (OHL) Ar Rass, plant to be located in the central eastern Province, north of Riyadh and near to Hail City, will have a generation capacity of 1,440 MW and is expected to produce 4,533 GWh per year. The project includes solar energy units to reduce power consumption from the grid.



Figure 1-: Overview of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) project

1.4 Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Development



ESIA Approach

1.4.1 Introduction

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) construction consists of several phases of design and construction regional infrastructure.

Objectives of ESIA

This assessment has been carried out to fulfill the NCEC's and Lending agency's Environmental Assessment requirements for new developmental projects. The main objective of this ESIA is to assess in advance the impacts from the construction phases of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project and to identify mitigation and control measures. The specific objectives of the study include:

1. To comply with the requirements for undertaking an ESIA Study prescribed by the NCEC and Equator Principles July 2020;
2. To determine existing environmental conditions (Baseline);
3. To assess environmental and socio-economic impacts from the construction and operation phase of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) project; and
4. To provide recommendations for monitoring and mitigation of significant environmental impacts.

The specific objectives of the ESIA study are:

- (a) To determine the baseline conditions covering natural, physical, and built-in environmental scenarios in the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project area
- (b) To identify and predict the environmental impacts and socio-cultural impacts of the proposed construction and operation of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project.
- (c) To elaborate mitigation measures for the negative environmental impacts.
- (d) To assess alternatives to the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project.
- (e) To develop Environmental Monitoring and Management Plan for construction and operation phases of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project.

It is anticipated that the ESIA study will provide a comprehensive description and evaluation of either the positive or the negative impacts on the physical and biological environments as well as both social



and economic status. The ESIA will also incorporate guidelines for mitigation and enhancement measures to avoid or reduce the adverse impacts according to the national environmental regulations. In order to fulfill the requirements of the client and NCEC behind this environmental and social impact assessment; this study includes the following:

- Review the different types of planned or/and proposed Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project activities that identify the likely pollution sources and hazards associated with their operations
- Define and assess the significance of the environmental risk and the possible extent associated with the proposed sources of pollution and the hazard identified;
- Propose to the master plant layout to accommodate these environmental risks;
- Air Quality and Noise levels

Table 1-1 Ar Rass Solar Independent PV Power Plant (AR-SIPVPP)-ESIAs Schedule

Deliverable	Description	Spatial Context	ESIA Draft Submission Date
Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) (Scope of this ESIA)	Earthworks, grading, compounds, on shore works excavations	North-Vacant Land East-Vacant Land, West – Access Road South –Vacant Land	June 2023
Main Works –ESIA	Construction works, foundations, structure, finishing and operations.	Ar Rass Solar Independent PV Power Plant (AR-SIPVPP)	July 2023

1.5 The ESIA Study

The purpose of an ESIA is to identify the positive and negative impacts caused by a project's activities on the environment. This is undertaken through an analysis of the effects resulting from the interaction between environmental and social components with various project activities during construction and, operation phases.

1.5.1 The Purpose of the ESIA Study

The objectives of this ESIA are aligned to the IFC PS1: Assessment and Management of Environmental and Social Risks, which are to:

- Establish the current environmental state of the Project area and surrounds;
- Identify sensitive components of the existing environment within the Project area and surrounding environment;
- Evaluate Project activities and determination of potential negative and positive impacts on the environment; and



- Recommend measures to be taken during construction, commissioning and operation to avoid and mitigate identified adverse impacts and enhance beneficial impacts.

1.5.2 The Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project works Scoping Report

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP) Project works Scoping report was issued to M/S ACWA Power Company (Saudi Listed Joint Stock Company), and NCEC in March 2023. The scope of which defines this ESIA as agreed with the NCEC and the M/S ACWA Power Company (Saudi Listed Joint Stock Company), EBC has proceeded with the ESIA development as outlined below.

1.5.3 Content of ESIA Report of ACWA Power Company (Saudi Listed Joint Stock Company), Construction works

Table 1-3 provides an overview of the structure and content of this ESIA Report.

Table 1-2 ESIA Report Structure

Section	Approach
Table of Contents	Provides an overview of each section of the ESIA including the main level headings.
List of Abbreviations	Provides a list of all abbreviations used in the ESIA Report.
Glossary	Provides an explanation of the key terms used within the ESIA.
Executive Summary	Provides a brief summary of the findings of the ESIA.
1. Introduction	Presents an overview of the Project and objectives of the ESIA. This Section also details the purpose and structure of the ESIA Report
2. Policy, Regulatory and Administrative Framework	Outlines the relevant legal framework and guidance applicable to the Project which are considered in the ESIA and Environmental and Social Management Plan (ESMP)
3. Project Description and Alternatives	Sets out an overall description of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass construction works. An assessment of alternatives to the proposed Project including the “no project” option and the various design and layouts alternatives are also presented
4. ESIA Methodology	Includes a description of the ESIA process and a general description of the impact assessment methodology and of the adopted impact significance criteria
5. Stakeholder Engagement	Describes the stakeholder engagement approach and a summary of Project consultation undertaken to date.
6. Air Quality 7. Noise and Vibration 8. Geology and Soils 9. Hydrology 10. Hydrogeology	This Section include: ➤ A description of the methods used and results from surveys and secondary data review to define baseline conditions relevant to the technical discipline;



11. Terrestrial Ecology 12. Social 13. Waste Management 14. Archaeology and Cultural Heritage 15. Landscape and Visual	➤ A description of mitigation measures incorporated into the Project design; ➤ An assessment of potential impacts arising from the Project and related activities; ➤ The identification of practicable additional mitigation measures to be applied; ➤ An assessment of residual impacts associated with the Project following mitigation; and ➤ A review of in-combination and unplanned events, and cumulative impact assessment.
16. Cumulative Impact Assessment	A summary of the potential cumulative impacts as a result of other existing and proposed development and associated facilities in the vicinity of the Project area and Project area of influence.
17. Framework Environmental and Social Management Plan	Includes a framework of the ESMP, providing a reference to the identified mitigation and management measures, to be implemented throughout the Project, based on the outcomes of the impact assessment.
18. Residual Impacts and Conclusion	A summary of the residual impacts arising as a result of the Project and provision of overall conclusions as to the overall environmental and social significance of impacts arising from the Project.
19	Summary, Conclusion and Recommendations
References	

1.6 Client and ESIA Team

1.6.1 Project Proponent

M/S ACWA Power Company (Saudi Listed Joint Stock Company), KSA is the client for this Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project. The key client contact details for the ESIA process is set out below:

Name	Eng. Khaled Almedbel
Position	Project Manager
Postal Address	ACWA POWER, KSA
Email	kalmedbel@acwapower.com

1.6.2 Environmental Balance Establishment

ESIA Project Manager contact details are set out below:

Name	Eng. Osama J Qurban
Position	Managing Director
Email	osama@ebe.com.sa
ESIA Project Manager	
Name	Dr Suresha Gududappa
Position	Senior Environmental Scientist
Email	suresh@ebe.com.sa



SECTION 2.0 POLICY, REGULATORY AND ADMINISTRATIVE FRAMEWORK



SECTION 2.0 POLICY, REGULATORY AND ADMINISTRATIVE FRAMEWORK

2.1 Introduction

This section outlines the national policies, laws, regulations, standards, and guidelines, as well as international conventions (to which the KSA as a sovereign state is a signatory) that apply to the environmental and social aspects of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project. As the impact assessment will be guided by International Finance Corporation (IFC) principles and guidelines, the social environment will be included in addition to the natural (physical and ecological) environment; hence a more comprehensive Environmental and Social Impact Assessment (ESIA) will be undertaken. The requirements stipulated within this framework encompass all aspects of the Project. The specific objectives of the regulatory framework review are:

- To identify policies, laws, and regulations applicable to the environmental and social aspects of the AR-SIPVPP Project, and to the conduct of the ESIA;
- To identify environmental standards prescribed under national legislation that shall apply to the Project;
- To identify approvals, licenses and permits required for the Project as stipulated under national legislation;
- To identify international conventions to which KSA is a signatory that shall apply to the Project; and
- To identify applicable international best practices and standards; including IFC Performance Standards (PS)

2.2 Regulatory Context for AR-SIPVPP Project

AR-SIPVPP project is governed by the laws and legislation of KSA. The government authority for the environmental legislative framework is the Ministry of Environment, Water, and Agriculture (MEWA). In addition, KSA is a signatory to international agreements and conventions as described in Section 2.5.

2.3 AR-SIPVPP –ESIA Strategy

The following principles have driven and continue to drive the approach to environmental standards on the AR-SIPVPP project:

- Development of AR-SIPVPP specific planning and regulation documents to guide master plan and development proposals to achieve the high environmental standards in line with both KSA and international requirements.



- Preparation of environmental and social impact assessments (ESIAs) for the project and all major components within it • Full compliance with all existing legislation of the Kingdom of Saudi Arabia KSA)
- Seeking to meet and exceed international best practice, as set out in the International Finance Corporation (IFC) performance standards (PS)
- Undertaking all assessment work to the highest possible quality, involving working with an appropriate organization with such an international reputation, and then working with an equivalent international organization to review and assess the quality of the work undertaken and its compliance with IFC PSs

2.3.1 KSA National Legislation and the Role of the Competent Authority

IFC performance standards require that the ESIA is in compliance with local regulation/law. This AR-SIPVPP project also required to conduct ESIA in compliance with IFC standards. Previously the environmental regulator in KSA was the General Authority of Meteorology and Environmental Protection (GAMEP), previously referred to as the Presidency of Meteorology and Environment (PME) under the MEWA. Then it is now renamed as National Center for Environmental Compliance (NCEC); on some smaller projects in other parts of the Kingdom it seems to continue to operate, but it is reported that it is in process of significant change and has no role at all on the regulation and approval of the ESIAs for the regional Mega projects. KSA law as set out in the General Environmental Regulations and Rules for Implementation (GERRI) requires the ESIA to be assessed by a competent authority. That competent authority can be defined by the project proponent.

2.3.2 IFC Alignment and Status of IFC/Equator Principles in KSA

All ESIA will be in compliance with the guiding principles of IFC performance standards. This will be independently assessed by the Environmental Consultant – an appointed ESIA assessor. A number of major financial institutions have signed up to the Equator Principles, which state that any project they are financing must be aligned with the IFC Performance Standards. If the project being financed is in a ‘Designated Country’ then it means that, as that country’s environmental regulation is considered (in the Equator Principles) as robust, the project only needs to show compliance with national regulation and does not need a full review against the IFC PS.

KSA is not listed as a ‘Designated Country’, leading to the interpretation that it does not have “robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the natural environment” as per the definition given by the Equator Principles.



As such, any project in KSA that receives finance from an Equator Principles institution would have to be aligned and reviewed against the IFC PS as well as adhering to national regulation and getting necessary approvals and permits.

2.3.3 Summary

The approach can, therefore, be summarized as follows:

- The project to target international best environmental practice, as defined in IFC performance standards
- Appoint internationally renowned teams to undertake the ESIA work
- Appoint internationally renowned teams to independently review the ESIA work
- Collaborate openly with the other regional projects, to share information and best practice
- Submit ESIA's to NCEC for approval
- Once approved submit ESIA's to MEWA for information only.

2.3.4 Protection of the Terrestrial Environment'

The Permanent Committee for the Protection of the Environment considers approvals for marine developments, and includes the following;

- NCEC;
- Ministry of Finance;
- Ministry of Environment Water and Agriculture;
- Ministry of Energy, Industry and Mineral Resources;
- Saudi Commission for Tourism and National Heritage;
- Saudi Wildlife Authority;/National Center for Wild life
- Ministry of Interior; and
- Ministry of Municipal and Rural Affairs.

Further understanding of the approvals and permits is required to facilitate consultation with the above stakeholders.

2.3.5 ESIA Assessor Role

Environmental Balance Company (EBC) is appointed by M/S ACWA Power Company (Saudi Listed Joint Stock Company) as the Independent ESIA Consultant.

The ESIA Consultant will:

- Prepare scoping reports and agree on scope with the ESIA consultant;



- Prepare ESIA's in compliance with international best practice guidelines (IFC PS and any other national and local regulations that may apply); and
- Technical sanity checks to identify technical gaps or inconsistencies.

2.3.6 Details of National Policies, Laws and Regulations

Within Saudi Arabia, all major development projects are subject to undergo the EIA process. The national requirement for the completion of EIA studies is set out in The General Environmental Regulation and Rules of Implementation, specifically within Article 5, which states: **Article 5-4** “Concerned, public and licensing agencies engaged in any of the various environmental activities, working in the field of protecting and developing natural resources, or licensing industrial and development projects that have potentially adverse environmental impacts shall coordinate with the Competent Agency to ensure commitment to conducting environmental assessment studies in accordance with the environmental rules and standards specified in Appendix 2.” Appendix 2.4 of the legislation provides “Guidelines for Compiling an Environmental Impact Assessment Study”, requiring a detailed description of the project, status of the surrounding environment, an assessment of all predicted impacts and a summary of these impacts post-mitigation. As the impact assessment will be guided by IFC principles and guidelines, the social environment will be included in addition to the natural (physical and ecological) environment; hence a more comprehensive ESIA will be undertaken. The overall aims of the ESIA process are to:

- Identify the nature and extent of environmental and social impacts resulting from the project under study;
- Facilitate the achievement of national and corporate environmental and social objectives;
- Provide possible project alternatives that may better conserve environmental resources;
- Provide a framework for the implementation of environmental standards within the design of the project under study;
- Provide options for economically viable resource conservation measures;
- Provide a framework for the implementation of waste minimization and pollution prevention opportunities at both construction and operational phases;
- Engage stakeholders and local communities; and
- Identify appropriate mitigation and monitoring measures during the various project phases.

Whilst all major development projects are required to pass through the ESIA process, the level



of reporting and detail required is subject to classifying projects into three individual categories based upon their predicted impacts.

The predicted impacts will define each project into three categories, as detailed in Table 2-1.

Table 2-1 ESIA Categories

Category No.	Description	Project examples*
1	<i>“Projects with Limited Environmental Impacts”</i> Covers projects that are not expected to have tangible adverse environmental and social impacts.	➤ Minor expansion of power lines (>10% of existing length); ➤ Expansion of existing roads (>15% of existing length/width); ➤ Modification/expansion of marine berthing without pollution impact of dredging; and ➤ Expansion of irrigation and drainage installations (>10% of installation)
2	<i>“Projects with Significant Environmental Impacts”</i> Covers projects that are likely to have some adverse environmental and social impacts that can be substantially mitigated and will not significantly impact areas beyond the site boundary.	➤ Block, brick, ceramic, china and porcelain factories; ➤ New or expanded hospitals; ➤ Power transmission lines and transformer stations; ➤ Petroleum gas and product storage facilities; ➤ Offshore and onshore pipeline projects (>50 km in length); and
3	<i>“Projects with Serious Environmental Impacts”</i> Covers projects that are likely to have significant adverse environmental and social impacts, which cannot be fully mitigated, and will cause likely affect to areas beyond the site boundary.	➤ Solar Power Plants; ➤ Cement plants; ➤ Urban development projects; ➤ Waste water treatment plants; ➤ International trans-boundary power transmission lines,

*This table provides a selection of project examples. For the complete list, see Appendix 2.1 of General Environmental Regulations and Rules for Implementation, 2001.

Source: General Environmental Regulations and Rules for Implementation, 2001.

Accordingly, each category is assigned particular reporting requirements, as detailed in Appendix 2.2, 2.3 and 2.4 of the General Environmental Regulations and Rules for Implementation. For Category 1 and 2 Projects, simplified ESIA (information forms) represent the minimum requirements, whilst for Category 3 a more detailed ESIA study is required.

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass project is considered to be classified as Category 2.



2.3.7 Detailed National Standards

In accordance with the General Environmental Regulation and Rules of Implementation, NCEC was charged with the overall responsibility of overseeing and enforcing all environmental affairs in KSA and a set of Environmental Standards were established. Although NCEC has been disbanded the Environmental Standards are still applicable are presented in Table 2-

Table 2-2 Environmental Standards, NCEC

Ref. No.	Environmental Standard	Description
1	<i>Material Recovery and Recycling of Waste</i>	This is a Guidance Document that has been compiled to provide the NCEC with a foundation on which to develop an effective programmed to implement best practice initiatives in relation to recovery and recycling of waste materials within KSA. Its purpose relates to the recovery and recycling of waste materials and follows the internationally recognized waste management 'hierarchy' of prevention, recycling, treatment and disposal. This Guidance Document extends to municipal, commercial, institutional and industrial wastes
2	<i>Mobile Source Emissions</i>	This standard sets the framework and activities required to enable sustainable management of mobile source emissions within the Kingdom of Saudi Arabia by introducing emission limits for individual pieces of equipment used outdoors. This standard refers to air emissions from no road engines, equipment and vehicles. This includes sources such as mobile generators, agricultural machinery and large earth-moving equipment
3	<i>Environmental Noise</i>	The General Environmental Standard for Noise provides a basis for statutory control to restrict and reduce the nuisance caused by environmental noise. The framework does not address the issue of occupational noise which falls under the jurisdiction of National Health and Safety Law and does not extend to noise from public transportation, including highways, railways and noise from commercial and private aircraft, including helicopters, both in flight and operating on the ground. This standard relates to the following types of environmental noise: community noise, noise from industrial units in areas set aside primarily for industrial facilities, noise from construction activities, noise from vehicles (including motorized vessels and recreational craft), and noise from equipment used outdoors.
4	<i>Control of Emissions to Air from Stationary Sources</i>	This standard sets out point source air quality standards for the Kingdom of Saudi Arabia for sustainable management of air quality within the Kingdom by introducing emission limits for individual facilities and assists in the protection of the Kingdom's public health, occupational health and natural ecosystems, including cropland, forest, desert and wetlands whilst allowing economic and social development. These standards apply to any facility, site, or premises whose activities give rise to air emissions from a stationary source, and does not include emissions from residential properties, natural events or mobile pollutant sources.



5	<i>Prevention of Major Accidents</i>	This standard aims to prevent major accidents, such as the release of toxic materials, the release of flammable materials, fires, explosions, major structural failures and those which involve dangerous substances. Where accidents do occur, this standard sets out a framework and controls for the mitigation of the impact on human health and the environment. Thus, it is applicable to all facilities irrespective of size or location, that produces, processes, uses, stores or otherwise handles dangerous substances in quantities equal to or in excess of those specified in Appendix A of the same standard.
6	<i>Storage and Material Reclamation Facilities –Design and Operation</i>	This Standard has effect for purposes connected with the regulation of waste and hazardous waste, and in particular for the purposes of the: i) design of new Storage and Material Reclamation Facilities which accept waste of all types from across the KSA whether a material or substance is inert, non-hazardous or a hazardous waste, as the case may be; ii) operation of Storage and Material Reclamation Facilities to ensure that the site is managed in a manner which will have the least possible impact upon the neighbouring environment or human health; The Standard is intended for use as a default position for Storage and MRF design and operation and applies to all new Storage and MRFs pre-development. However, existing storage and MRF operators must, as far as practicable, implement the relevant best practice measures contained within this Standard. This Standard does not apply to i) management of Radioactive waste; ii) management of liquid wastes; or iii) management of sludge's, including sewage sludges and sludges from dredging operations. As well as does not provide detailed information or guidance on the operation of different facilities.
7	<i>Thermal Treatment and Incineration – Design and Operation</i>	This Standard has effect for purposes connected with the regulation of waste and hazardous waste, and in particular for the purposes of the: i) Design of new incineration plants that accept waste from across the KSA whether material or substance is inert, non-hazardous or hazardous waste, as the case may be. ii) Operation of incineration plants to ensure that the sites are managed in a manner which will have the least possible impact upon the neighbouring environment or human health; The Standard is intended for use as a default position for thermal treatment and incineration design, operation and site closure. This Standard applies to mass burn incineration techniques, waste to energy facilities and the advanced thermal treatment processes of pyrolysis and gasification.
8	<i>Waste Acceptance Criteria</i>	The objective of this standard is to establish the framework for PME to develop waste acceptance criteria for waste generators and Treatment Storage and Disposal facility operators with the aim of reducing the environmental impact of landfills. Where all the limit values for Waste Acceptance Criteria are met, the waste will be accepted for final disposal at a hazardous waste landfill site. Where the limit values are not met, then the waste must be treated to bring it within the required acceptance limits or an alternative disposal route must be sought.



		This standard extends to all waste types including hazardous, non-hazardous and inert waste. Under this standard, hazardous wastes will only be accepted at hazardous waste landfills after it has been treated or stabilized to minimize hazards and then disposed of at landfills that offer an appropriately high standard of environmental protection.
9	Waste classification	The objective of this document is to establish a national baseline Waste Classification System within the Kingdom of Saudi Arabia and should be applied by all waste handlers to whom they apply with inspections taking place to verify their implementation. This standard does not apply to the following waste streams: i) Discharges of industrial and municipal wastewater to central treatment works or directly to the environment – The Industrial and Municipal Wastewater Discharges and Ambient Water Quality Standards control and manage wastewater discharges. ii) Radioactive waste, other than that produced in the course of healthcare treatment procedures
10	Drinking water quality	These standards relate to the quality standards stipulating the quality requirements of any drinking water intended for human consumption, with the exception of bottled or packaged water. The standards shall apply to any water intended for drinking irrespective of the source (municipal supplies, rainwater tanks, boreholes, etc.) or where it is consumed (including the home, restaurants, camping areas, shops). These standards do not address water used for specialized purposes such as renal dialysis and some industrial purposes where water of higher quality may be required. These standards do not apply to private water supplies on the condition that the volume of that supply does not exceed 10m ³ per day on an annual average.
11	Biological Treatment – design and operation	This Standard has effect for purposes connected with the treatment and disposal of biodegradable waste, and in particular for the purposes of the: (i) design of new biological treatment facilities which accept biodegradable waste from across the KSA; and (ii) operation of biological treatment facilities to ensure that the sites are managed in a manner which will have a least possible impact upon the neighbouring environment or human health; This Standard applies to all new biological treatment pre development. However, existing biological treatment facility operators must, as far as practicable, implement the relevant best practice measures contained within this Standard. This Standard sets out the design parameters and operational requirements for biological treatment facilities in the KSA. It applies to commercial and/or publicly operated biological treatment facilities. The provisions of this standard are therefore not applicable to domestic biological processes such as home composting initiatives operated by householders at their place of residence
12	Waste regulatory control and compliance	The objective of this standard is to establish the framework for PME to develop and integrate systems for the management of the movement of waste in KSA. Among others the framework includes



		the assignment of a Duty of Care to Waste Handlers, tracking systems, prior notification systems for hazardous waste activities, systems for registering waste Transporters and the regulation of Generators and Treatment, Storage and Disposal (TSD) facilities, a waste licensing regime for storage, treatment and disposal facilities. This standard aims to assist improved control of environmental pollution, protect public health and welfare and minimize the impact upon economic development. This standard applies to all Generators, Transporters and TSD Facility operators in KSA and extends to all waste types including hazardous, non-hazardous and inert waste.
13	Waste handling and storage	The objective of this standard is to ensure the effective handling and storing of waste so as to prevent and minimize spills and leakages that may pose a threat to the environment and/or human health. These standard guides those handling and storing waste in good operating practices, in managing effective waste storage and segregation systems, and in detecting, containing and cleaning up any leaks that may occur. It applies to Waste Handlers who handle and store waste from the point of generation through to the storage of waste where it is held at a facility prior to its onward transfer for recycling, treatment or disposal. The handling and storage of waste at recycling, treatment and disposal facilities are covered in the design and operation waste standards for these facilities that accompany this series of Waste Standards. This Standard does not detail the requirements of protecting employees from the effects of handling hazardous wastes in the workplace such as risk assessments, monitoring, PPE or ventilation systems. These requirements must be complied with separately as per health and safety related Standards
14	Waste training and assessment of technical competence of operators	The objective of this standard is to establish the framework to ensure that efficient, nuisance-free and environmentally acceptable waste management procedures are practiced in KSA by outlining the minimum requirements for training, certification and assessment of persons participating in or responsible for the operation of treatment, storage and disposal facilities. This standard is to be applied by PME or other PME approved bodies with responsibility for assessing the technical competence of designated facility operators and extends to all TSD Facilities required to be licensed under the Waste Regulatory Control and Compliance Standard. This standard does not apply to industrial waste water facilities, sewerage systems and waterworks treating liquid wastes, or to facilities used solely for the disposal of liquid municipal or industrial wastes
15	Waste transportation	The objective of this standard is to establish the requirements necessary to ensure that the transportation of waste in KSA is undertaken in a responsible manner to safeguard the protection of the environment and the community against potential accidents, spills and pollution.



		It also provides guidance for transporters to harmonize classification and labelling requirements for all hazardous substances, chemicals, drugs and dangerous goods in line with internationally recognized controls The transboundary movement of waste must be properly monitored and controlled to protect both human health and the environment. It must also promote the principles of priority for recovery, national self-sufficiency and proximity in waste disposal This Standard utilizes the waste classification and definitions as stated in the provisions of the Waste Classification Standard and does not extend to provisions covering radioactive waste or explosives. This Standard does not apply to the on-site transportation of waste within a facility's property boundary.
16	Landfill – design and operation	The objective of this standard is to establish the framework which facilitates the: (i) design of new solid waste landfill facilities which accept waste of all types from across the KSA whether material or substance is inert, non-hazardous or hazardous waste; and (ii) operation of a solid waste landfill to ensure that the sites are managed in a manner that will have the least possible impact upon the neighbouring environment or human health. The Standard is intended for use as a default position for landfill design, operation, site closure and remediation. The Standard applies to all new landfills' pre-development. However, existing landfill operators must, as far as practicable, implement the relevant best practice measures contained within this Standard This Standard does not apply to the: (i) management of radioactive waste; (ii) management of liquid wastes; (iii) spreading of sludge's, including sewage sludges and sludges from dredging operations for the purposes of fertilization or land improvement; or (iv) remediation of existing landfill sites.
17	Industrial and municipal wastewater discharges	The objective of this Standard is to control the quality of direct discharges from facilities and persons operating in KSA, contributing to meeting KSA's ambient water quality objectives. These standards utilize use-related criteria and specify limits on individual discharges designed to protect those uses. Discharges shall include any liquid effluents or process water which is not classified as clean unpolluted surface runoff including storm water, or other such as waste chemicals, including oils; liquid process wastes; detergents; condensate water; cooling water; biodegradable substances; wash water; ballast water; liquid wastes or wash waters, domestic sewage, wastewater discharged using sinks, basins or toilets; contaminated mine or quarry water; all sanitary wastewaters; treated effluents from constructed treatment wetlands (municipal and industrial); the reject water These standards shall apply to any installation, site or premises that produce discharges as defined above. Sanitary Wastewater discharges from off-shore facilities shall be governed by the relevant regional discharge requirements.



18	Best practicable environment option for waste disposal	The BPEO is the waste management system that achieves effective and affordable waste management with minimum cost and maximum benefit to the environment, society and the economy and is, therefore, one of the key principles to guide progress towards more sustainable waste management practice. The BPEO concept is thus clearly consistent with the objectives of sustainable development. The aim of this Guidance Note is to provide PME with a stepwise route through the process of deciding preferred BPEOs. The BPEO for a particular waste stream may vary determined by local circumstances affecting the practicality, cost, and environmental and social benefits that take into account national objectives for sustainable waste management. The choice is therefore complex and considers many different factors when recommending the preferred BPEO
19	Ambient air quality	The objective of this standard is to set out the Kingdom of Saudi Arabia Air Quality Standards for sustainable management of ambient air quality within the Kingdom of Saudi Arabia. It introduces a baseline standard for air quality which aims to protect the Kingdom's public health and natural ecosystem including cropland, forest, desert and wetlands whilst allowing economic and social development. This standard relates specifically to the ambient air quality and prescribes limit values for ambient air quality parameters. This standard establishes the responsibilities of the Competent Agency with regards to managing ambient air quality in the Kingdom.
20	Ambient water quality	The objective of this standard is to establish the framework and the activities required to enable sustainable management of ambient water quality within the Kingdom of Saudi Arabia and introduces a baseline standard of water quality which aims to protect the Kingdom's water supply and natural aquatic environment whilst allowing for sustainable economic and social development. These Standards refer to the safety, aesthetic, physical and chemical aspects of ambient waters for the protection of human uses and the environment including ecology and recreation. Subject to the exemptions prescribed in Article I (6), these standards apply to all underground waters and include any surface freshwater that may be present permanently or temporarily.

Source: NCEC

The environmental standards for air (Ref. No. 19), noise (Ref. No. 3) and water (Ref. No. 20) were updated in 2014, and granted a five-year grace period to correct their status.

In 2006, the Ministry of Water and Electricity (MWE) issued new standards for wastewater reuse for agricultural irrigation. The standards, provide the maximum allowable contaminant levels for the reuse of wastewater for agricultural irrigation. The standards for restricted and unrestricted agricultural irrigation include parameters such as pH, total dissolved solids, turbidity, phenol, some of the heavy metals, ammonia, nitrate, free residual chlorine, and fluoride.

2.3.8 National Guidelines



The National Spatial Strategy refers to national development corridors as an essential measure to manage long-term spatial development and to ensure effective and efficient integrations of different regions of the country.

The overall goal of the National Spatial Strategy is to achieve balanced development in the Kingdom of Saudi Arabia and to build substantial linkages between rural and urban areas. In addition to development corridors, the strategy seeks to diversify economic centers in different regions to fully utilize their existing and potential resources.

2.4 Detailed International and Regional Conventions and Protocols

KSA has ratified or is a signatory to a number of international agreements and conventions presented in Table 2-3

Table 2-3 Treaties, Conventions and Protocols

Treaties, Conventions and Protocols	Date of Ratification or Assession (a) (by KSA)	Description
Stockholm Convention (2001)	25/07/2012	The Stockholm Convention is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms and are toxic to humans and wildlife.
Rotterdam Convention (1998)	07/09/2000 (a)	The Rotterdam Convention (formally, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade) is a multilateral treaty to promote shared responsibilities in relation to the importation of hazardous chemicals. The convention promotes an open exchange of information and calls on exporters of hazardous chemicals to use proper labeling, include directions on safe handling, and inform purchasers of any known restrictions or bans. Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged to make sure that producers within their jurisdiction comply.
Agenda 21 of the UN conference on Environment and Development, 1992	06/04/1992	Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment. Agenda 21 is a non-binding action plan of the United Nations with regard to sustainable development. It is a product of the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro



		Brazil, in 1992. Its aim is achieving global sustainable development.
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Convention) and 1996 Protocol	02/02/ 2006	The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, commonly called the "London Convention" or "LC '72" and also abbreviated as Marine Dumping, is an agreement to control pollution of the sea by dumping and to encourage regional agreements supplementary to the Convention. Its objective is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter. Currently, 87 States are Parties to this Convention.
Convention Concerning the Protection of the World Cultural and Natural Heritage 1972 (World Heritage Convention)	07/08/1978	The Convention concerning the Protection of World Cultural and Natural Heritage was adopted by the General Conference of UNESCO on 16 November 1972. The same General Conference adopted on 16 November 1972 the Recommendation concerning the Protection, at National Level, of the Cultural and Natural Heritage. The Convention recognizes the way in which people interact with nature, and the fundamental need to preserve the balance between the two. The Convention defines the kind of natural or cultural sites which can be considered for inscription on the World Heritage List.
UN Convention to Combat Desertification, 1977	25/06/1997(a)	The international community has long recognized that land degradation/desertification is a major economic, social and environmental problem of concern to many countries in all regions of the world. In 1977, the United Nations Conference on Desertification (UNCOD) adopted a Plan of Action to Combat Desertification (PACD).
International Convention for the Safety of Life at Sea (SOLAS), 1974 (as amended) with its Protocol of 1978	24/07/1985 (a)	The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, and the fourth in 1960. The 1974 version includes the tacit acceptance procedure – which provides that an amendment shall enter into force on a specified date unless, before that date, objections to the amendment are received from an agreed number of Parties. As a result, the 1974 Convention has been updated and amended on numerous occasions. The Convention in force today is sometimes referred to as SOLAS, 1974, as amended. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done.
UN Convention on the Law of the Sea	24/04/1996	The United Nations Convention on the Law of the Sea (UNCLOS), also called the Law of the Sea Convention or the Law of the Sea treaty, is the international agreement that



(UNCLOS), 1982 (Articles 198 and 221)		resulted from the third United Nations Conference on the Law of the Sea (UNCLOS III), which took place between 1973 and 1982. The Law of the Sea Convention defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. The Convention, concluded in 1982, replaced the quad-treaty 1958 Convention on the High Seas.
Vienna Convention for the Protection of the Ozone Layer, 1985	01/03/1993	The Vienna Convention for the Protection of the Ozone Layer is 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. The Convention was adopted by the Conference on the Protection of the Ozone Layer and open for signature at Vienna from 22 March 1985 to 21 September 1985, and at the United Nations Headquarters in New York from 22 September 1985 until 21 March 1986.
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989	07/03/1990	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on 22 March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland, in response to a public outcry following the discovery, in the 1980s, in Africa and other parts of the developing world of deposits of toxic wastes imported from abroad. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" – household waste and incinerator ash.
International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention)	30/07/2009	The OPRC (1990), provides a global framework for international co-operation in combating major incidents or threats of marine pollution. Parties to the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) are required to establish measures for dealing with pollution incidents, either nationally or in co-operation with other countries. Ships are required to carry a shipboard oil pollution emergency plan. Operators of offshore units under the jurisdiction of Parties are also required to have oil pollution emergency plans or similar arrangements which must be coordinated with national systems for responding promptly and effectively to oil pollution incidents.
International Convention for the Prevention of Pollution from Ships (MARPOL)	02/10/1983	MARPOL provides regulations aimed at preventing and minimize both pollution of the oceans and seas, including pollution from oil, noxious liquids, harmful substances, sewage, general waste and air pollution from ships.



Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	03/12/1996	CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.
ROPME -Regional Organization for the Protection of the Marine Environment	24/04/1978	<i>The Convention is the basic legal instrument binding the eight States of the Region to coordinate their activities towards protection of their common marine environment. The Convention consists of thirty Articles broadly dealing with responsibilities of the Contracting States for the protection and preservation of the marine environment which is under constant threat of pollution from offshore and land-based activities as well as marine transport. The Convention was adopted with the objective to ensure that development projects and other human activities do not in any way cause damage to the marine environment, jeopardize its living resources or create hazards to human health. Another objective of the Convention was the development of an integrated management approach to the use of the marine environment and the coastal areas in a sustainable way which will allow the achievement of environmental and developmental goals in a harmonious manner. To this effect, the importance of cooperation and coordination of action on a regional basis with the aim of protecting the marine environment and the coastal areas for the benefit of present and future generations, is emphasized throughout the Convention. The Convention which was signed on 24 April 1978, entered into force on 1 July 1979 and enjoys the participation of eight Parties. No Signatories without ratification, acceptance, approval or accession.</i>
Convention on Biological Diversity, 1992	06/05/1992	The Convention on Biological Diversity (CBD) is an international legally-binding treaty with three main goals: conservation of biodiversity; sustainable use of biodiversity; fair and equitable sharing of the benefits arising from the use of genetic resources. Its overall objective is to encourage actions, which will lead to a sustainable future. The Convention was adopted by the Intergovernmental Negotiating Committee for a Convention on Biological Diversity, during its Fifth session, held at Nairobi from 11 to 22 May 1992. The Convention was open for signature at Rio de Janeiro by all States and regional economic integration organizations from 5 June 1992 until 14 June 1992 and remained open at the United Nations Headquarters in New York until 4 June 1993.



UN Framework Convention on Climate Change, 1992 and the Paris Agreement (UN Framework Convention on Climate Change), 2016	12/28/1994 11/03/2016	The United Nations Framework Convention on Climate Change (UNFCCC or FCCC) is an international environmental treaty negotiated at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992. The objective of the treaty is to “stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.” The treaty itself set no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. The Convention was agreed upon and adopted by the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change, during its Fifth session, the second part, held in New York from 30 April to 9 May 1992. In accordance with its article 20, the Convention was open for signature by States Members of the United Nations or of any of its specialized agencies or that are Parties to the Statute of the International Court of Justice and by regional economic integration organizations, at Rio de Janeiro during the United Nations Conference on Environment and Development, from 4 to 14 June 1992, and remained thereafter open at the United Nations Headquarters in New York until 19 June 1993.
UN Educational, Scientific and Cultural Organization (UNESCO) Convention on the Protection of the Underwater Cultural Heritage, 2001	13/11/2015	The UNESCO Convention on the Protection of the Underwater Cultural Heritage, adopted in 2001, is intended to enable States to better protect their submerged cultural heritage. The Convention (i) sets out basic principles for the protection of underwater cultural heritage; (ii) provides a detailed State cooperation system, (iii) provides widely recognized practical rules for the treatment and research of underwater cultural heritage.
Convention for the Safeguarding of the Intangible Cultural Heritage, 2003	10/01/2008	The General Conference of the United Nations Educational, Scientific and Cultural Organization hereinafter referred to as UNESCO, meeting in Paris, from 29 September to 17 October 2003, at its 32nd session, agreed upon the Convention with the purposes of: a. to safeguard the intangible cultural heritage; b. to ensure respect for the intangible cultural heritage of the communities, groups and individuals concerned; c. to raise awareness at the local, national and international levels of the importance of the intangible cultural heritage, and of ensuring mutual appreciation thereof; d. to provide for international cooperation and assistance.



<i>The Montreal Protocol on Substances that Deplete the Ozone Layer, 1987</i>	03/01/1993	The Montreal Protocol is a global agreement to protect the stratospheric ozone layer by phasing out the production and consumption of ozone-depleting substances (ODS). The Protocol was adopted by the Conference of Plenipotentiaries on the Protocol on Chlorofluorocarbons to the Vienna Convention for the Protection of the Ozone Layer, held in Montreal from 14 to 16 September 1987. Open for signature in Montreal on 16 September 1987, in Ottawa from 17 September 1987 to 16 January 1988 and at United Nations Headquarters, New York, from 17 January 1988 to 15 September 1988, in accordance with article 15.
<i>Kyoto Protocol to the UN Framework Convention on Climate Change, 1997</i>	31/01/2005	In the Kyoto Protocol, Parties in Annex I of the Framework Convention on Climate Change (FCCC) agreed to commitments with a view to reducing their overall emissions of six greenhouse gases (GHGs) by at least 5% below 1990 levels between 2008 and 2012. The protocol also establishes emissions trading, joint implementation between developed countries, and a "clean development mechanism" to encourage joint emissions reduction projects between developed and developing countries.

KSA adopted Agenda 21 of the United Nations Division for Sustainable Development and its policies on the environment and development. Accordingly, the use of the natural and environmental resources of the Kingdom has been ascertained with the purpose of satisfying requirements without tampering with the capabilities and rights of future generations.

2.5 International Best Practice Standards and Guidelines

The proponent of a project must always demonstrate how it will conform to relevant environmental standards and international industry best practices. M/S ACWA Power Company (Saudi Listed Joint Stock Company) aims to follow recognized international standards in terms of environmental and social management, as a guaranty to comply with any national legislation requirement relevant to the Project and as a matter of quality and reputation. Furthermore, M/S M/S ACWA Power Company (Saudi Listed Joint Stock Company) has adopted the International Finance Corporation (IFC) requirements, amongst others, as the guiding principles for assessing potential impacts of the Project. It has not been ruled out that M/S ACWA Power Company (Saudi Listed Joint Stock Company) may seek to involve independent financial investors and lenders in the Project. Financial investors and lenders may be members of the Equator Principles (EP) group of financial institutions. As such, it is good practice to consider the International Finance Corporation (IFC) requirements for assessing the potential impacts of the Project.

The ESIA has been prepared in line with the following international guidance:



- International Best Practice Standards and guidelines, including the IFC Performance Standards on Environmental and Social Sustainability. This includes guidance published by the World Bank Group, World Health Organization (WHO) and the International Union for the Conservation of Nature (IUCN);
- Good International Industry Practices (GIIPs); and
- Relevant international agreements and conventions to which KSA is a signatory

2.5.1 Detailed International Finance Corporation Regulations

The ESIA will be guided by the Environmental Health and Safety (EHS) guidelines developed by the World Bank Group and the IFC. The IFC Performance Standards (PS) are directed towards project developers, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations for the Project. IFC uses a process of environmental and social categorization to reflect the magnitude of risks and impacts. The categories that may be applicable are:

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

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass project is considered to be classified as Category A. IFC has established eight performance standards and these are summarized in Table 2-4.

Table 2-4 IFC Performance Standards

IFC	Standard	Overview
PS 1	<i>Assessment and Management of Environmental and Social Risks and Impacts</i>	Establishes requirements for social and environmental performance management throughout the life of a project.
PS 2	<i>Labour and Working Conditions</i>	Highlights the need for workers' rights regarding income generation, employment creation, relationship management, commitment to staff, retention and staff benefits.
PS 3	<i>Resource Efficiency and Pollution Prevention</i>	Defines an approach to pollution prevention and abatement in line with current



	internationally disseminated technologies and good practice.

Source: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policiesstandards/es-categorization

IFC	Standard	Overview
PS 4	Community Health, Safety and Security	Specific requirements for mitigating any potential for community exposure to risks and impacts arising from equipment accidents, structural failures and releases of hazardous materials.
PS 5	Land Acquisition and Involuntary Resettlement	Recognizes that project related land acquisition and restrictions could have an adverse effect on communities or persons that use the land and outlines a policy to avoid or minimize involuntary physical resettlement as a consequence of development.
PS 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources	Sets out an approach to protect and conserve biodiversity, including habitats, species and communities, ecosystem diversity, and genes and genomes, all of which have potential social, economic, cultural and scientific importance.
PS 7	Indigenous Peoples	Recognizes that Indigenous Peoples can be marginalized and vulnerable (e.g. if their lands and resources are encroached upon by or significantly degraded by a project).
PS 8	Cultural Heritage	Aims to protect irreplaceable cultural heritage and to provide guidance for protecting cultural heritage throughout a project's life cycle.

Performance Standard	Applicability	Note
PS 1: Assessment and Management of Environmental and Social Risks and Impacts Identify project E&S risks and impacts Adopt mitigation hierarchy (anticipate/avoid, minimize, compensate/offset) Improve performance through an Environmental and Social Management System (ESMS) Engagement with Affected Communities, other stakeholders	Yes	Applies to all projects that have environmental and social impacts. Addressed by this ESIA Report including the sections describing the Project's environmental and social management programs No affected communities are identified at Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Site.
PS 2: Labour and Working Conditions Fair treatment, non-discrimination, equal opportunity Good worker – management relationship Comply with national employment and labor laws Protect workers, in particular vulnerable categories • Promote safety and health • Avoid use of forced labor or child labor	Yes	Applies to workers directly engaged by the client (direct workers), workers engaged through third parties (contracted workers), as well as workers engaged by the client's primary suppliers (supply chain workers).



PS 3: Resource Efficiency and Pollution Prevention • Avoid, minimize, and reduce project-related pollution • More sustainable use of resources, including energy and water • Reduced project-related Greenhouse Gas (GHG) emissions	Yes	Implementation of the actions necessary to meet the requirements of the PS is managed through the clients ESMS. The project will be designed to operate in compliance with the relevant World Bank EHS Guidelines.
PS 4: Community Health, Safety, and Security • To anticipate and avoid adverse impacts on the health and safety of the Affected Community • To safeguard personnel and property in accordance with relevant human rights principles	Yes	No affected Community in the Project area of influence is and limited to other workers, fishermen and potentially communities far away from the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project site.
PS 5: Land Acquisition and Involuntary Resettlement • Avoid, minimize adverse social and economic impacts from land acquisition or restrictions on land use • Improve or restore livelihoods and standards of living • Improve living conditions among displaced persons	No	The Project does not require additional land, as expected land requirements fall within the existing Vacant area at Ar Rass.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources • Protection and conservation of biodiversity • Maintenance of benefits from ecosystem services • Promotion of sustainable management of living natural resources	Yes	The Project's Construction works in particular the excavation and piling may modify natural habitat with poor diversity, and none them with potential significant biodiversity value.
PS 7: Indigenous Peoples • Ensure full respect for IPs (human rights, dignity, aspirations, livelihoods, culture, knowledge, practices) • Avoid, minimize adverse impacts • Sustainable and culturally appropriate development benefits and opportunities • Free, Prior and Informed Consent (FPIC) in certain circumstances	No	There are no indigenous people as defined by PS present in the Project's area of influence.
PS 8: Cultural Heritage • Protection and preservation of cultural heritage • Promotion of equitable sharing of cultural heritage benefits	No	The terrestrial part of the Project is located in an vacant land. There are no known cultural heritage features within the project footprint

2.5.2 IFC Industry Specific Health and Safety Guidelines

Environmental Health and Safety (EHS) guidelines have been developed by the World Bank Group and the IFC. The applicable guidelines to be considered include:



- EHS General Guidelines (2007), including but not limited to:

- Air Emissions and Ambient Air Quality;
 - Energy Conservation;
 - Wastewater and Ambient Water Quality;
 - Waste Management;
 - Hazardous Materials Management;
 - Occupational Health and Safety;
 - Water and Sanitation; and
 - Community Health and Safety.
- Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013).

2.5.3 IFC Social and Stakeholder Engagement Guidelines

The ESIA is prepared in line with best practices put forward in the IFC guidelines and in particular:

- 2012 Environmental Health and Safety (EHS) guidelines
- 2007 Stakeholder Engagement Handbook⁸;
- 2009 Good Practice Note Addressing Grievances from Project-Affected Communities;
- 2009 Handbook for Addressing Project-Induced In-Migration¹⁰; and
- 2009 Introduction to Health Impact Assessment¹¹.

2.5.4 WHO Guidelines

Relevant WHO guidelines relevant and used within this ESIA include:

- International Finance Corporation, Environmental, Health, and Safety Guidelines: General EHS Guidelines (2007).
- International Finance Corporation, Good Practice Handbook, Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013).
- International Finance Corporation, Good Practice Note Addressing Grievances from Project-Affected Communities (2009).
- International Finance Corporation, Good Practice Note Addressing Grievances from Project-Affected Communities (2009).
- International Finance Corporation, Handbook for Addressing Project-Induced In-Migration (2009). International Finance Corporation, Introduction to Health Impact Assessment (2009).
- WHO Air Quality Guidelines (2005);
- WHO Guidelines for Community Noise (1999); and
- WHO Guidelines for Drinking Water Quality (2011).

2.6 Project Policies and Standards



Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass project sets objectives that will guide achieving international standards for sustainable development. These sustainable development standards are described in Section 3.2. In order to achieve the high-quality Potable water services objectives, set for itself, the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass project will, in part, need to be governed outside the full framework of Kingdom regulations and agencies., therefore, international policies and standards should be aligned with the national level policies such as “Vision 2030”, the National Transformation Program; and National Spatial Strategy. World Health Organization, Air Quality Guidelines, Global Update (2005), World Health Organization, Guidelines for Community Noise (1999), and World Health Organization, Guidelines for Drinking Water Quality (2011).

2.7 References

- GAMEP/NCEC Environmental Standards. (2014). Ambient air quality.
- GAMEP /NCEC Environmental Standards. (2014). Ambient water quality.
- GAMEP/NCEC Environmental Standards. (2014). Best practicable environment option for waste disposal.
- GAMEP /NCEC Environmental Standards. (2014). Biological Treatment – design and operation
- GAMEP/NCEC Environmental Standards. (2014). Control of Emissions to Air from Stationary Sources.
- GAMEP /NCEC Environmental Standards. (2014). Drinking water quality
- GAMEP /NCEC Environmental Standards. (2014). Environmental Noise.
- GAMEP/NCEC Environmental Standards. (2014). Industrial and municipal wastewater discharges.
- GAMEP/NCEC Environmental Standards. (2014). Landfill – design and operation
- GAMEP/NCEC Environmental Standards. (2014). Material Recovery and Recycling of Waste
- GAMEP /NCEC Environmental Standards. (2014). Mobile Source Emissions.
- GAMEP /NCEC Environmental Standards. (2014). Prevention of Major Accidents.
- GAMEP /NCEC Environmental Standards. (2014). Storage and Material Reclamation Facilities – Design and Operation.
- GAMEP/NCEC Environmental Standards. (2014). Thermal Treatment and Incineration – Design and Operation
- GAMEP /NCEC Environmental Standards. (2014). Waste Acceptance Criteria.
- GAMEP/NCEC Environmental Standards. (2014). Waste classification.
- GAMEP /NCEC Environmental Standards. (2014). Waste handling and storage.
- GAMEP/NCEC Environmental Standards. (2014). Waste regulatory control and compliance.
- GAMEP /NCEC Environmental Standards. (2014). Waste training and assessment of technical competence of operators.
- GAMEP/NCEC Environmental Standards. (2014). Waste transportation.



SECTION 3.0 DESCRIPTION OF THE PROJECT



SECTION 3.0 DESCRIPTION OF THE PROJECT

3.1 Project Location and Configuration

The proposed site for the Project is located approximately 24 km south-east of the city of Ar Rass in Al Qassim Province. The location is an undeveloped and unfenced area of approximately 57.6 km². The Project location is shown in Figure 1-1; whereas, Figure 3-1 shows the Project general layout (a higher resolution figure is presented in Appendix C) and Table 3-1 presents the coordinates of the site boundaries.

Table 3-1 Project Site Coordinates (WGS84 zone 38N)

Point	Easting	Northing
Pto-1	43.57155	25.61813
Pto-2	43.62129	25.61861
Pto-3	43.72329	25.62339
Pto-4	43.71212	25.59529
Pto-5	43.62175	25.57889
Pto-6	43.57202	25.57841

The Project installed capacity is 2,620 MW which is equivalent to generating approximately 7,006 GWh per year. It should be noted that this capacity is the initially estimated capacity and should be confirmed or updated, as necessary as part of the detailed design of the Project.

The total number of SGUs is eight (8). The capacity of the SGUs will be between 120-700 MW; one small unit with capacity 120 MW, six SGU have a capacity 300 MW and one (1) larger unit with capacity 700 MW., and each will have a dedicated 33/132 kV step-up substation (SGUS) that will connect to a central 132/380kV Switching Substation (SS) where it will collect the energy evacuated from SGUSs (Figure 3-1).

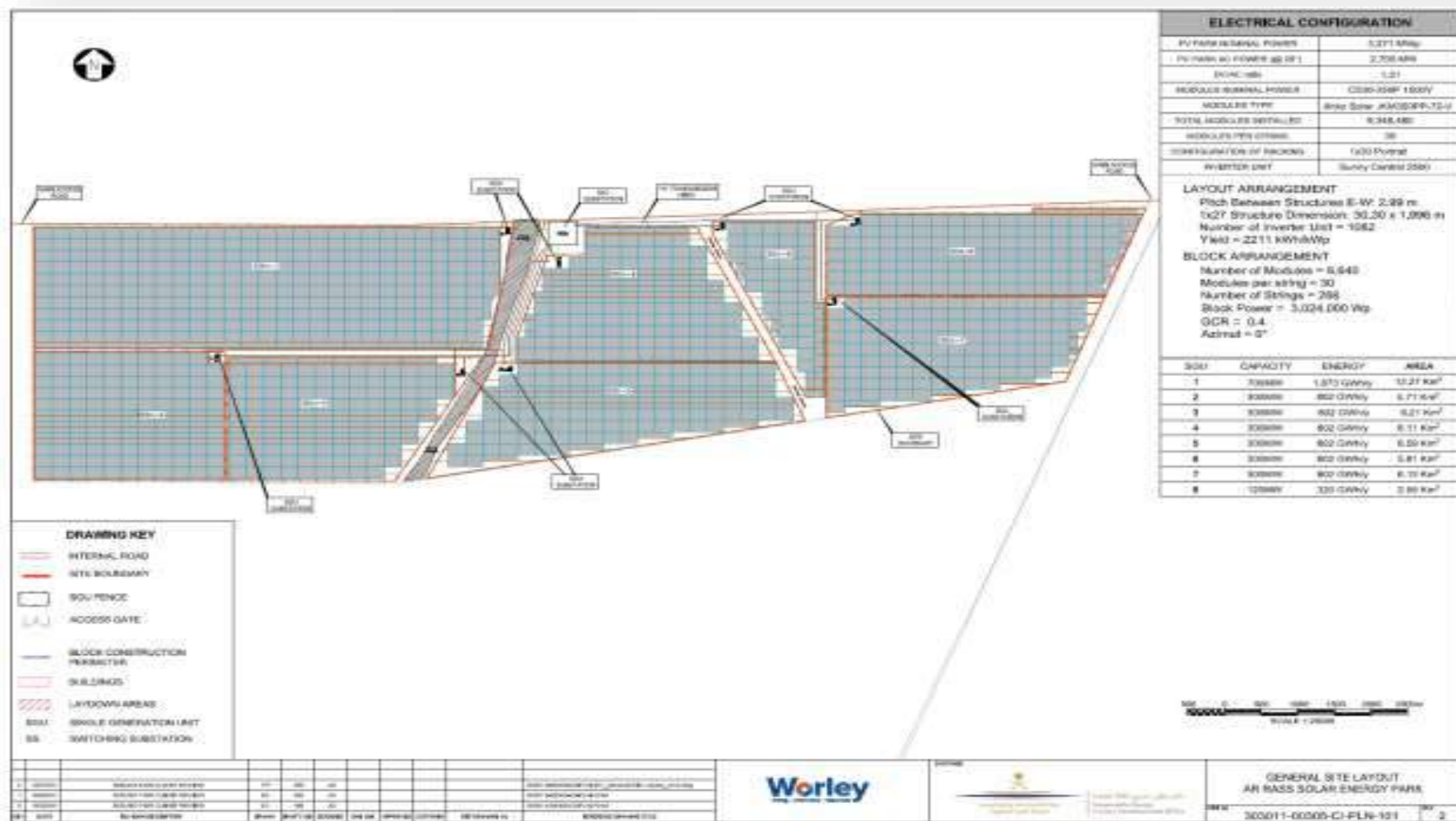


Figure 3-1 General Layout of the Project





The Substations, both the SS and SGUSs, will be Gas Insulated Substation type. Each SGUs will be connected to the SS through a 132 Kv Double circuit over-head line (OHL), as shown in Figure 3-2



Figure 3-2 PV Plant and Transmission Over-head Line Example

3.2 Project Components

The main components of the proposed Project are as follows:

- PV modules
- 1,048 Inverter stations, including all MV components (transformers, MV switchgear, inverters,
- communications, control units and auxiliary services), as shown in Figure 3-3
- Cabling (DC, AC, LV and MV and HV) necessary for collecting and transporting energy will be selected and sized to withstand local conditions (e.g., temperature and radiation) and to minimize energy losses
- Earthing system
- Racking system, single-axis tracking
- A Fence will be installed around the site that complies with Saudi Arabian Standards
- Roads
- Security system and intruder detection system for each
- Instrumentation and control system, SCADA
- Interconnection with the Saudi Arabian Transmission System
- 380 kV overhead transmission line from the SS to the existing 380 kV lines



- Internal 132 kV high voltage evacuation lines from the SGU to the SS
- Eight (8) 33/110kV SGU substations (SGUSs)
- Buildings: interconnection cabin, Administration and Control building and associated facilities, storage and maintenance, and control access
- Infrastructure including:
 - Roads and access
 - Buildings
 - Water supply
 - Stormwater management

It should be noted that the Switching Substation is to be developed by SEC and thus outside the scope of the present study.

The main characteristics of the configuration of the Project are summarized in Table 3-2.



Table 3-2 Characteristics of the Main Configuration of the Project

Project Configuration	
Number of SGU	8
Mounting System	Single-axis tracking
Power per SGU (MW)	700/300/120
Nominal Power (MWp)	3,168
AC Power (25°C) (MW)	2,620
DC/AC Ratio	1.21
PV Module	Canadian CS6U 350P 1500V
PV Modules Nominal Power (Wp)	350
Total PV Modules Installed	9,088,974
Number of PV Modules per String	30
Inverter power (kW)	2,500
Ground Coverage Ratio (GCR) (%)	0.4



The typical drawings of key equipment and the plant layout has been provided in Appendix C. The generalized drawings reflect the equipment and configurations selected in this report and could vary from the final installation. However, the design does reflect the most common types of systems and equipment. More details on some of the key components are presented below.

3.2.1 Polycrystalline PV Modules

The PV module Canadian CS6U 350P 1500V manufactured by Canadian Solar has been selected as the basis for the design and yield estimates. However, other PV panel types would be also suited for the proposed Project. The typical specifications are presented in Table 3-3.

Table 3-3 PV Module Specifications

Parameter	Value
Maximum Power (Pmax)	350 Wp
Power Tolerance	0-5 W
Maximum Power Voltage (Vmp)	38.1 V
Maximum Power Current (Imp)	9.21 A
Open-circuit Voltage (Voc)	46.2 V
Short-circuit Current (Isc)	9.79 A
Module Efficiency STC (%)	18
Maximum System Voltage (Vdc)	1500 Vdc
Operating Temperature (°C)	-40°C~+85°C
Temperature Coefficients of V oC	-0.29 %/°C
Module Dimensions (mm ²)	1960 x 992

A typical Polycrystalline PV module is shown in Figure 3-4. In general, the PV panels are predominantly black in appearance – when viewed directly from the front. The front surface of a typical solar panel is toughened glass with an anti-reflective coating to maximize the light captured by the solar cells and reduce glare back towards the atmosphere.



Figure 3-4 Polycrystalline PV Module



3.2.2 Inverters

Each 300 MW SGU collects the energy from 120 inverter stations, 280 inverter stations for the 700 MW SGU and 48 inverter stations for the 120 MW SGU. The Project will be developed considering central inverters, because they are recommended for large commercial and utility-scale plants (> 100 MW) and have a long and proven track record. The inverter skid will comprise the inverter, the LV/MV transformer, the MV Switchgear and the associated auxiliary services electrical panels and communication panels.

The Sunny Central 2500-EV manufactured by SMA was selected as the basis for the design and yield estimates. This inverter is representative of the industry standard and is extremely common with a long and proven track record. However, a number of inverter types, sizes and manufacturers would be suitable for this Project. The inverter stations technical specifications of Sunny Central 2500-EV are included in Appendix E.

3.2.3 Interconnection

All interconnection components are designed according to SEC standards and specifications. Inside the Project area there are about 22 km of overhead 132 kV lines and about 793 m of underground 132 kV lines. The interconnection with the national grid will be made at the high voltage side of the Step-up transformer in the 132/380kV substations.

3.2.4 Infrastructure

3.2.4.1 Roads and Access

The Project will require the transport of materials and workers mainly during the construction phase. The construction of access road(s) to the site will be required to enable delivery of the main equipment. A temporary access road will be used during the construction stage until the permanent roads are completed.

A main access road, asphalted and 20 m in width, will be constructed to connect the Project with Highway 411(as shown in Appendix C). The remainder internal roads will mostly be unpaved compacted access roads, with some paved roads to facilitate the access within the Project site for installation and maintenance purposes.

3.2.4.2 New Buildings

The proposed Project will require several onsite buildings to be constructed for the operational requirements:

- Administration and Control building in the Service Area
- Storage and Workshop building
- Substation buildings



- Security gate house and support building, in accordance with High Commission for Industrial Security (HCIS) SEC-03 requirements

3.2.4.3 Site Security

For health, safety and security reasons the Project site will be surrounded with a security fence. This will keep both the environs safe from possible accidents and keep the Project proponents' investment safe. It is furthermore, recommended that closed circuit video-surveillance system will be fitted around the plant also for safety reasons.

3.2.4.4 Water Supply

A low salinity water source will be required for periodical cleaning of the PV panels during the operation phase. The water required for panel cleaning will be provided by water trucks from local suppliers. This will most likely be the optimum solution as overall water consumption will be limited and the water quality can be specified in the supply contract. Other water supply alternatives might be investigated at a later stage of the Project such as the utilization of a dedicated pipeline.

Steel water storage tanks will be constructed on site. These will be supplied by regular loads of water trucks. The tanks will be connected to the administration building; they will supply the cleaning trucks and will provide fire protection water to the Project.

3.2.4.5 Stormwater Management System

The Project site will be serviced by a stormwater management system which aims to separate clean from dirty surface water. All clean water will be directed away from the site, where as the contaminated water will be directed and collected within a stormwater management system. The aim of this system is to protect the health, welfare and safety of personnel, and to protect property from flood hazards by safely routing and discharging stormwater away from and within the site

3.3 Construction Phase

3.3.1 Construction Activities Description

3.3.1.1 Civil Works

The main civil works are as follows:

- Rerouting existing underground services, such as piping, cabling and ducts, if necessary
- Civil works for discharging rainwater, if necessary
- General site filling, levelling and grading to the necessary lines and levels, and all other earthworks, where required, including access areas.
- Construction of new roads, pavements and parking areas as part of the required infrastructure;



- Security fence, lighting system and surveillance system in accordance with HCIS (class-3) SEC-02, SEC-04 and SEC-05 requirements.
- Security gate
- Solar array foundations/piling
- All civil works for the solar array of each SGU, which typically include the following works and systems:
 - Complete civil works for the solar field
 - Trenches
 - Service roads
 - Local infrastructure
 - Any other outdoor civil works required inside the Project or as needed for interconnection to the grid.
- Civil works required for the administration and workshop building, the control building, the substations buildings, and the security gate house and support building.

Earthworks will be required during construction to remove loose sand and to reinforce unstable areas. In general, the site is designed with the aim of minimizing earthworks. Construction of the proposed Project and the associated infrastructure will require above ground buildings, installation of panels and construction of roads. Construction works will require temporary labour force, as well as vehicle movements and construction machinery.

3.3.2 Construction Schedule and Workforce

Due to the extremely large scale of the proposed Project, the Project will most likely be constructed in several phases. It is anticipated that, the construction of each 300 MW will take approximately 18 months. Depending on the intensity of the construction (timeline, parallel projects) there could be up to 600 people per each constructed 300 MW.

3.3.3 Construction Workers Accommodation

Construction workforce will be accommodated at Ar Rass city, as far as practical due to its relatively proximity to the Project site and the workers will be bussed in each day. In addition; and given the number of workers during the construction phase, the need for onsite accommodation camp is anticipated. The exact location of the onsite accommodation will be determined prior to the construction commencement; however, it will be within the area officially allocated for the Project. The camp will be designed in a manner that is fully compliant with the relevant national regulations; furthermore, IFC and EBRD guidelines on workers accommodation will be taken into consideration (for more details please refer to Section 2.3.4.6 and Appendix F).



3.3.4 Lay-down area

A laydown area within the boundaries of each of the eight SGUs is set aside for the temporary storage of materials during the construction activities as well as the assembly of PV modules. The laydown area is approximately 200 m X 200 m for each SGU. In addition, temporary construction offices will also be required. These offices will most likely be mobile offices and also of a temporary nature.

3.4 Operation Phase

Generally, the operation of the proposed Project entails the production of power by conversion of solar energy to electricity. The PV power generation process is primarily self-sufficient and is not in need of constant supervision. The resources required for operation include:

- Solar radiation;
- Water;
- Consumables, including but not limited to spare parts and equipment, detergents and fuel.

The outputs from the Project during routine operation include:

- Power
- Solid waste (hazardous and non-hazardous) and liquid effluents (non-hazardous)
- Waste water from washing off PV panels

3.4.1 Operation Activities Description

The two main activities during this phase are operation & maintenance as well as panel cleaning as further detailed below.

3.4.1.1 Operation & Maintenance

In general, the Project will be operated and maintained with the objective to maximize energy production at minimum costs, following SEC and Control Centre requirements. The main Operation and Maintenance (O&M) activities will include the following, as a minimum:

- Periodic supervision of equipment with the aim to reduce the number of failures and the need of corrective maintenance activities, thus maximizing energy generation
- Inspection and maintenance of equipment and installations according to the O&M manual, the manufacturers' recommendations, and good utility practice
- Repair breakdowns and failures of equipment under normal operating conditions according to the O&M manual, the manufacturers' recommendations, and good utility practice
- Cleaning PV modules (more details are presented in Section 3.4.1.2)
- Managing spare parts
- Monitoring and reporting



- Site Security Furthermore, the operation of each SGU is based on the following:
- The PV modules are connected in series up to the rated voltage of the inverter, referred to as a string
- Strings are connected to electrical panels known as Combiner Boxes, which are in turn connected to the inverters
- The inverters transform the DC current into AC current, and the LV/MV transformers connected to the inverters step-up the voltage to a 33kV level. Transformers are protected by 33kV protection switchgears. The 33kV switchgears of the SGUs are connected by underground lines (feeders) to the 33kV switchgear in the step-up substation
- The step-up substation collects all feeders from the PV field and steps up the voltage from 33kV to 132 KV. Each 33kV feeder collects 15-20 MW
- A SCADA system is installed for the control, operation and monitoring of the SGU PV field and step-up substation
- The SGU Substations are connected by 132kV overhead lines (OHLs) to the switching substation (SS), where the voltage is stepped up to 380kV
- The Project will be connected to existing 380kV OHLs through which all of the energy generated by the Project will be evacuated to the existing electrical grid

3.4.1.2 Panels Cleaning

Two main cleaning systems will be considered:

- A semi-automated option that will consist of a truck/tractor configuration with customized cleaning equipment and large water tank. The cleaning mechanisms will be a combination of high-pressure water and spinning brushes
- A fully-automated cleaning rig which will run along the panels as a track and clean the panels.

These systems have a very low consumption of water and require minimal labour input.

The preferred option will be determined prior to the initiation of the Project.

3.4.2 Design Life and Availability

The Project shall be designed for a 25-year lifecycle. Equipment shall be designed to withstand normal operation and conditions during this period. The availability of the Plant will be higher than 99%, which does not consider periods when the grid may be unavailable.

3.4.3 Operation Workforce

During operation phase, it is expected that a total of 300 workers will be required.



3.5 Materials Used During Construction and Operation

3.5.1 Water

In general, no water sources are available on site and all water has to be delivered by trucks and stored in large tanks on site.

The daily potable water consumption for the construction workers is estimated to be approximately 393 m³/d. This number is based on the total number of workers at peak construction activities (i.e. 5,240 workers present at the same time as worst-case scenario)⁵. There is no available estimate for the construction activities water consumption at this early stage of the project; however, it should be determined prior to commencement of works.

During operation, annual water consumption quantity will depend on the frequency of cleaning and on the type of cleaning technology selected. Using standard cleaning technology and based on average soiling rates, the plant is expected to consume around 105,000 m³ of water per year to ensure the performance of the panels is maintained. This preliminary figure for water consumption estimated during scoping has yet to be refined in the detailed design. Potable water is also required during the operation phase for the onsite workers. The potable water daily consumption for the operations workers is estimated to be approximately 22.50 m³/d. This number is based on the total number of workers (i.e. 300 workers)⁵. During the operation phase, water will be supplied using trucks and stored onsite in large tanks, similar to the approach followed in the construction phase. Other water supply alternatives might be investigated at a later stage of the Project such as the utilization of a dedicated pipeline.

Depending on the quality of the selected water source, it may be necessary to construct a water treatment plant to obtain the required water quality for panels cleaning. The need for a water treatment plant, and consequently its specifications, will be determined at a later stage of the Project development.

3.5.2 Construction Materials

Materials required (aggregates, etc.) will be acquired from the local market. There is no available estimate of the quantities of these materials at this early stage of the project; however, they should be determined prior to construction commencement.

3.5.3 Hazardous Chemicals

There is no available estimate of the quantities of these materials at this early stage of the project; however, they should be determined prior to construction commencement. In general, it is anticipated that there will be a variety of chemicals stored and used during construction and operation of the Solar Power Plant, as listed in Table 3-4 below. In general, the different chemicals will be handled taking into consideration their properties and following the best practices.



Table 3-4 Hazardous Materials

Project Phase	Hazardous Materials
Construction	• Liquid fuels including diesel, petrol and gas (LPG) and lubricating and hydraulic oils will be used extensively by vehicles, pumps and generators; Cement and concrete admixture chemical will be used for the provision of • concrete for substations, building bases and platforms; cement and concrete; • Gases: oxygen, acetylene and nitrogen; • Paints, coatings, grease and chemical cleaners for general use
Operation	• Hydraulic and lubricating oils and greases contained within the synchronous condensers; • Insulating oil contained in the inverter/transformers and substations; • Gelled sulphuric acid electrolyte contained in batteries associated with the control room emergency power supply system; • Small quantities of hydraulic and lubricating oils and greases, fuels (gas, petrol and diesel) • Epoxy resins and hardeners (contained in fibreglass repair kits) • Coolants, thread glues, paints, degreasers, • Pesticides and herbicides associated with hygiene and maintenance activities; • Gases such as oxygen, acetylene nitrogen; • Sulphur hexafluoride (SF6) gas contained within high voltage equipment.

3.6 Wastes and Emissions

3.6.1 Wastewater and Sewage

During construction, sanitary waste streams will be generated from the construction camp, and portable toilets. The wastewater will be appropriately collected in dedicated septic tanks and they will be emptied and serviced on a regular basis by an approved contractor. The estimated daily wastewater generation during the construction phase is approximately 314.4 m³/d. This is based on the assumption that wastewater represents approximately 80% of the domestic water demand indicated in Section 3.5.16. During operation phase, wastewater generating from the panel cleaning is expected to generate. Furthermore, sanitary waste streams will be generated at both the administrative building and at the operations building and maintenance areas. Each area will have a kitchen as well as the requisite number of toilets and showers to support the staff active onsite. At these locations, a fully contained septic tank and leach field will be used to capture and treat the flows. As and when required, the septic tank (solids holding tank) will be cleaned out by a vacuum truck and the wastes will be trucked and disposed of at a licensed facility. The estimated daily domestic wastewater generation during the operation phase is approximately 18 m³/d. This is based on the assumption that wastewater represents approximately 80% of the domestic water demand indicated in Section 3.5.1.



3.6.2 Solid Waste

Solid waste is expected to be generated during construction and operation. This will likely include construction waste (debris, discarded concrete, empty drums) and municipal solid waste (paper, cardboard, plastic and other packages, food waste). Municipal waste will be collected in dedicated places onsite and disposed of by a specialized contractor at the local municipal landfill site. Construction waste will be reused as much as possible in construction activities, or alternatively it will be disposed of at an authorized landfill site. Another potential source of solid wastes is the damaged PV panels, if any during the installation. There are different management alternatives for the damaged panels, including return to supplier, offsite disposal at licensed facility and recycling at licensed facility, as far as practical. The final selection of the management approach shall be determined at the early start of the construction phase. There will be limited production of wastes during the proposed Project operation; these will most probably include oil, oily rags, scrap metal, replaced machine components etc. which will be disposed offsite according to relevant national legislation. Another potential source of solid wastes during this phase is the damaged solar panels, if any. The management approach for the damaged panels, if any will be similar to those followed during the construction phase (e.g., return to supplier, etc.). The final selection of the management approach shall be determined at the early start of the operation phase.

3.6.3 Air Emissions

Dust and particulate generation are expected to occur during the construction phase. Furthermore, heavy equipment will produce exhaust emissions from diesel engines leading to temporary increase in SO₂, NO_x, and CO₂ concentrations. The release of carbon monoxide (CO) occurs as a result of incomplete combustion of fuel in engines. No air emissions are expected during the operation phase. Furthermore, the proposed Project is expected to significantly reduce the emission of CO₂ greenhouse gases by seven (7) million tons of CO₂ equivalent.

3.6.4 Noise

The possible source of noise levels is the construction phase is equipment and machinery. Table 3-5 shows the maximum typical sound pressure levels for some of the construction equipment to be used in the proposed construction activities as per Defra7 noise database for prediction of noise on construction and open sites

Table 3-5 Typical Sound Pressure Levels for Construction Equipment

Equipment	A-weighted Sound Pressure Level, LAeq dB
Tracked excavator (loading dump truck)	85
Grader	86
Dump truck (tipping fill)	79



During operation, a potential noise sources are the substations, inverter stations and transformers. The noise level at 10m from the inverter (Sunny Central 2500-EV) is 64.3 dB(A). The noise levels vary depending on the specifications of the substation. The average noise level of the operating substation is 80 to 100 dBA (C. Chen et. al., 2014).

3.7 Decommissioning Phase

Decommissioning phase is associated with activities related to the demolition of infrastructure and the rehabilitation of disturbed areas. All construction material, equipment, temporary facilities, and waste will be removed from the site. Topsoil will be backfilled where required, including landscaping to achieve proper drainage. The majority of the semiconductor material and of the glass can be recovered and recycled. The remaining materials (e.g., glass fines, dust) are collected and properly disposed of according to local regulations. Rehabilitation works will ensure that the total area will be free draining, covered with topsoil. No decommissioning plan is yet available; however, the following activities can be anticipated in association with the decommissioning phase:

- Existing buildings and structures demolished, rubble removed, and the area levelled;
- Remaining exposed excavated areas filled and levelled using overburden recovered from stockpiles;
- Stockpiles and tailings impoundments to be smoothed and contoured;
- Topsoil replaced using topsoil recovered from stockpiles
- The following dust-generating activities may be expected during decommissioning:
 - Smoothing of stockpiles by bulldozer
 - Grading of sites
 - Transport and dumping of overburden for filling
 - Infrastructure demolition and piling of Infrastructure rubble
 - Transport and dumping of building rubble
 - Transport and dumping of topsoil
 - Preparation of soil for re-vegetation

Of importance is the disposal of the PV panels at the end of the decommissioning phase because of their extremely large number exceeding 9 million pieces. In general, there are different management alternatives for the panels, including return to supplier, offsite disposal at licensed facility and recycling at licensed facility, as far as practical. The final selection of the management approach shall be determined at the early start of the decommissioning phase.



SECTION 4.0. EXISTING ENVIRONMENTAL PROFILE



SECTION 4.0. EXISTING ENVIRONMENTAL PROFILE

4.1 General Introduction

This section comprises a description of the baseline environment appropriate to the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project site and surrounding area. Baseline conditions may also be referred to as the environmental setting, existing conditions and other similar terms. The baseline conditions are the physical, chemical, biological, economic and cultural setting in which the proposed project is to be located, and where local impacts (both positive and negative) might be expected to occur. Such baseline data provide information on the characteristics and features of the proposed project environment. It also provides the background/scientific basis for predicting, evaluating and mitigating the impacts of the planned project activities on the environment, monitoring environmental changes in the area as well as support the decision making in future project design, operation and management. Their description and characterization are also necessary for decision makers, reviewers and others who are unfamiliar with the project site and surrounding landscape.



Figure 4-1: Location of the Project site

The environmental baseline data acquisition for the EBA of the proposed project was undertaken by means of literature search, site visit, field measurements, observations etc. The Project area was surveyed during March 2023- April 2023. At all of the sampling points, surveys were



undertaken for evidence of, terrestrial ecology, archaeological features of interest, evidence of surface water, waste air quality, and noise survey at identified areas.

It is well known that the Arabian region in general is unusual climatically in that it is the most arid part of the Indo-Pacific, with the greatest year-round insulation and the greatest seasonal fluctuations of air and water temperatures (Sheppard, *et al.*, 1992). These features combine to create some of the most extreme climatic regimes to be found anywhere in the tropics (Sheppard, *et al.*, 1992). Consequently, there is a greater range of environments providing biota with both **optimal and highly stressed conditions** in this corner of the Indo-Pacific.

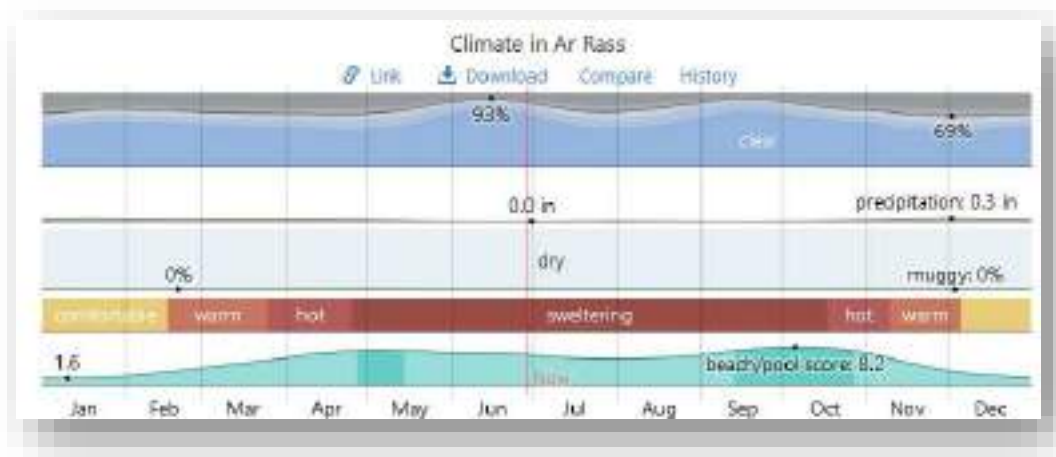
The Arabian region is also unusual geographically in that it is the only part of the Indo-Pacific realm which includes very large, **semi-enclosed bodies of water** the Arabian region (Sheppard, *et al.*, 1992).

Having this description of the Central Saudi Arabia in mind especially its highly stressed conditions and its semi-enclosed nature, the present environmental services for AR-SIPVPP is given below.

4.2 Meteorological Conditions

Climate and Average Weather Year-Round in Ar Rass Saudi Arabia

In Ar Rass, the summers are long, sweltering, and arid; the winters are cool and dry; and it is mostly clear year-round. Over the course of the year, the temperature typically varies from 43°F to 110°F and is rarely below 34°F or above 113°F.

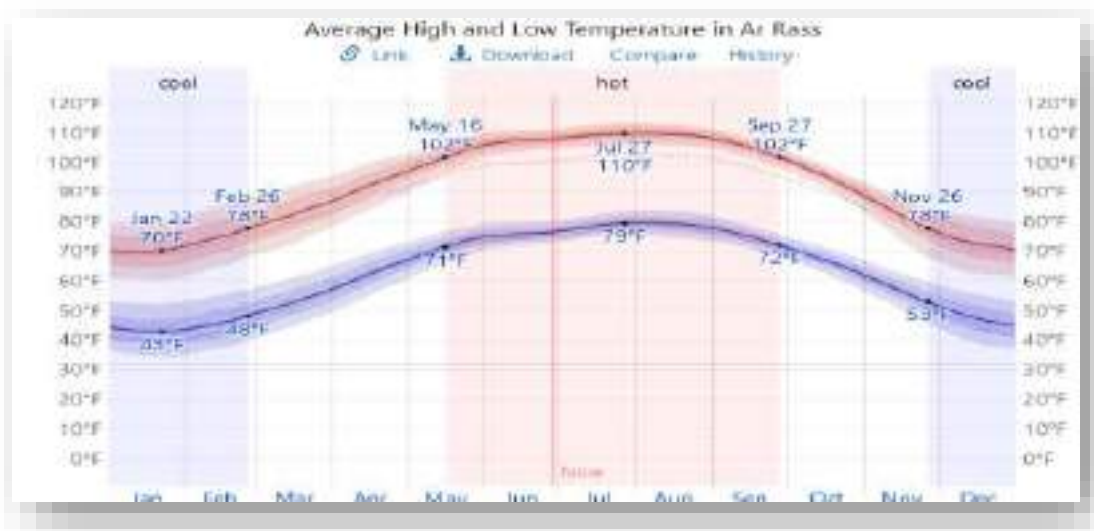


Average Temperature in Ar Rass

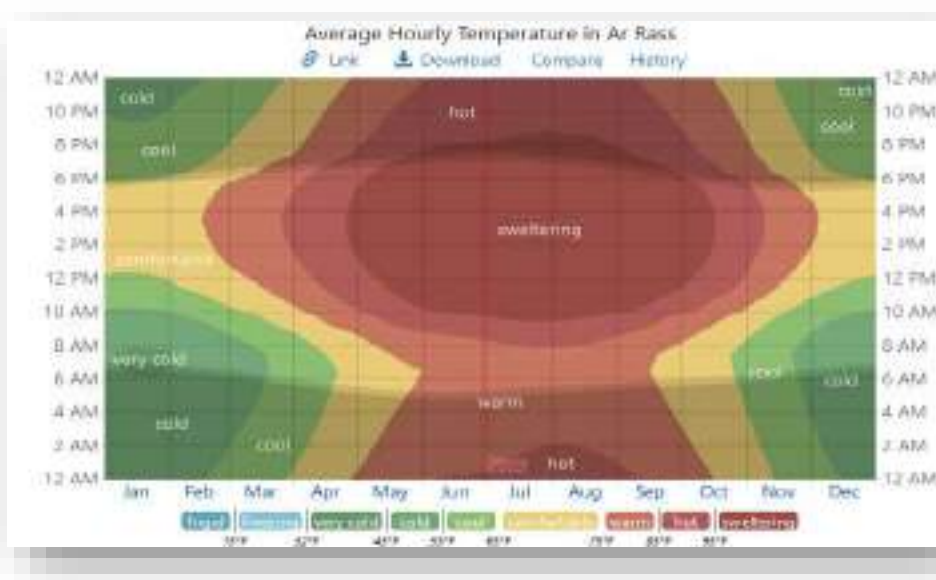
The hot season lasts for 4.4 months, from May 16 to September 27, with an average daily high temperature above 102°F. The hottest month of the year in Ar Rass is August, with an average high of 109°F and low of 79°F. The cool season lasts for 3.0 months, from November 26 to



February 26, with an average daily high temperature below 78°F. The coldest month of the year in Ar Rass is January, with an average low of 43°F and high of 70°F.



Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	70°F	75°F	83°F	92°F	102°F	107°F	109°F	109°F	105°F	95°F	82°F	73°F
Temp.	55°F	59°F	67°F	77°F	87°F	92°F	94°F	95°F	89°F	80°F	68°F	59°F
Low	43°F	46°F	53°F	63°F	72°F	76°F	79°F	79°F	74°F	66°F	56°F	47°F



Clouds

In Ar Rass, the average percentage of the sky covered by clouds experiences significant seasonal variation over the course of the year. The clearer part of the year in Ar Rass begins around May 20 and lasts for 1.6 months, ending around July 8. The clearest month of the year in Ar Rass is September, during which on average the sky is clear, mostly clear, or partly cloudy 91% of the time. The cloudier part of the year begins around July 8 and lasts for 10 months, ending around



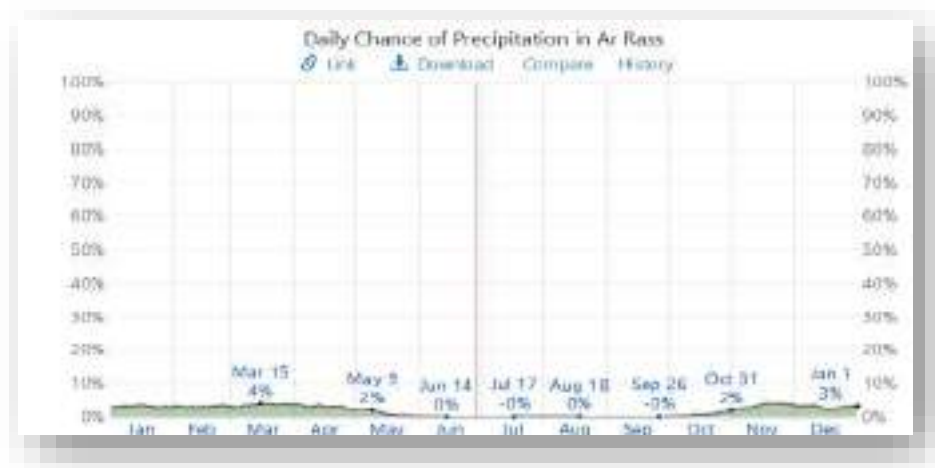
May 20. The cloudiest month of the year in Ar Rass is December, during which on average the sky is overcast or mostly cloudy 30% of the time.



Fraction	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cloudier	24%	24%	27%	28%	20%	10%	22%	19%	9%	19%	27%	30%
Clearer	76%	76%	73%	72%	80%	90%	78%	81%	91%	81%	73%	70%

Precipitation

Ar Rass does not experience significant seasonal variation in the frequency of wet days (i.e., those with greater than 0.04 inches of liquid or liquid-equivalent precipitation). The frequency ranges from -0% to 4%, with an average value of 2%. Among wet days, we distinguish between those that experience rain alone, snow alone, or a mixture of the two. The month with the most days of rain alone in Ar Rass is March, with an average of 1.1 days. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 4% on March 15.





Days of	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain	0.9d	0.8d	1.1d	0.9d	0.3d	0.0d	0.0d	0.0d	0.0d	0.2d	1.0d	0.9d

Rainfall

To show variation within the months and not just the monthly totals, we show the rainfall accumulated over a sliding 31-day period centered around each day of the year. Ar Rass experiences some seasonal variation in monthly rainfall. Rain falls throughout the year in Ar Rass. The month with the most rain in Ar Rass is January, with an average rainfall of 0.3 inches. The month with the least rain in Ar Rass is September, with an average rainfall of 0.0 inches.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	0.3"	0.2"	0.2"	0.2"	0.1"	0.0"	0.0"	0.0"	0.0"	0.0"	0.2"	0.2"

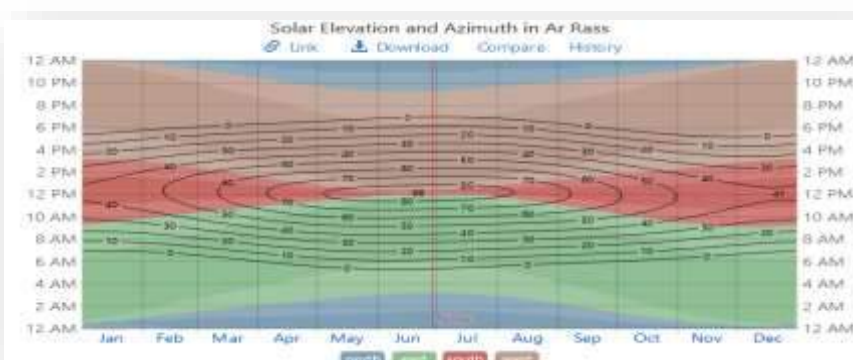
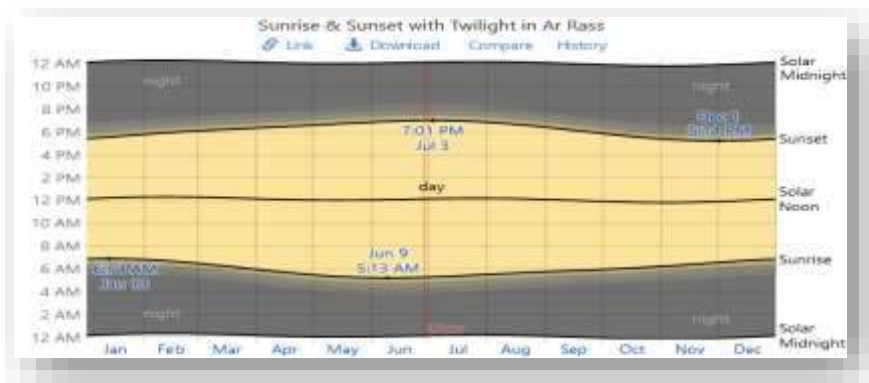
Sun

The length of the day in Ar Rass varies over the course of the year. In 2023, the shortest day is December 22, with 10 hours, 31 minutes of daylight; the longest day is June 21, with 13 hours, 45 minutes of daylight.





Hours of	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daylight	10.7h	11.3h	12.0h	12.8h	13.4h	13.7h	13.6h	13.0h	12.3h	11.5h	10.9h	10.6h



Moon

The figure below presents a compact representation of key lunar data for 2023. The horizontal axis is the day, the vertical axis is the hour of the day, and the colored areas indicate when the moon is above the horizon. The vertical gray bars (new Moons) and blue bars (full Moons) indicate key Moon phases.





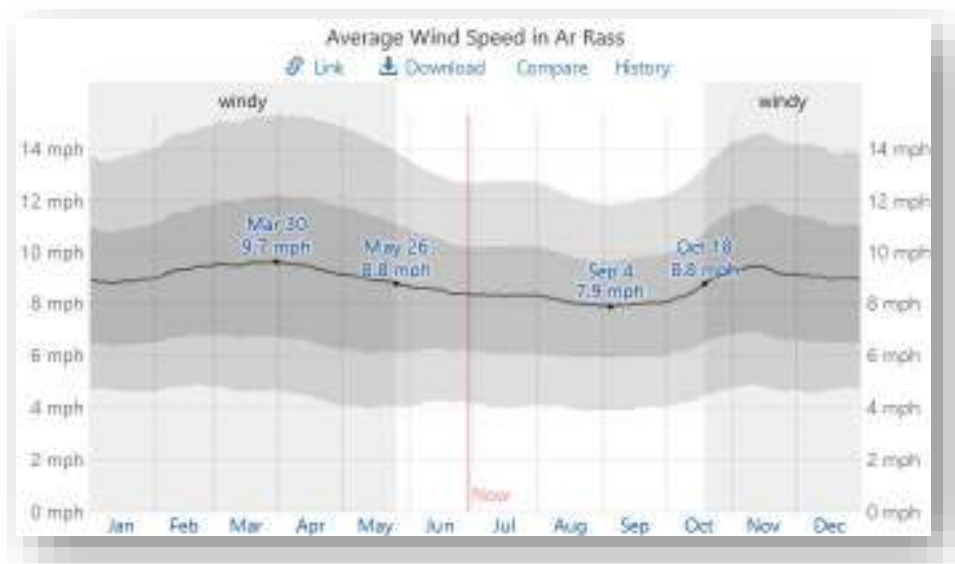
Humidity

We base the humidity comfort level on the dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid. Unlike temperature, which typically varies significantly between night and day, dew point tends to change more slowly, so while the temperature may drop at night, a muggy day is typically followed by a muggy night. The perceived humidity level in Ar Rass, as measured by the percentage of time in which the humidity comfort level is muggy, oppressive, or miserable, does not vary significantly over the course of the year, remaining a virtually constant 0% throughout.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Muggy days	0.0d	0.0d	0.0d	0.0d	0.0d	0.0d	0.0d	0.0d	0.0d	0.0d	0.0d	0.0d

Wind

This section discusses the wide-area hourly average wind vector (speed and direction) at 10 meters above the ground. The wind experienced at any given location is highly dependent on local topography and other factors, and instantaneous wind speed and direction vary more widely than hourly averages. The average hourly wind speed in Ar Rass experiences mild seasonal variation over the course of the year. The windier part of the year lasts for 7.2 months, from October 18 to May 26, with average wind speeds of more than 8.8 miles per hour. The windiest month of the year in Ar Rass is March, with an average hourly wind speed of 9.6 miles per hour. The calmer time of year lasts for 4.8 months, from May 26 to October 18. The calmest month of the year in Ar Rass is September, with an average hourly wind speed of 8.0 miles per hour.





	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind Speed (mph)	8.9	9.3	9.6	9.4	8.9	8.5	8.3	8.1	8.0	8.7	9.3	9.0



Best Time of Year to Visit

To characterize how pleasant the weather is in Ar Rass throughout the year, we compute two travel scores. The tourism score favors clear, rainless days with perceived temperatures between 65°F and 80°F. Based on this score, the best times of year to visit Ar Rass for general outdoor tourist activities are from late February to mid-April and from mid-October to early December, with a peak score in the second week of November



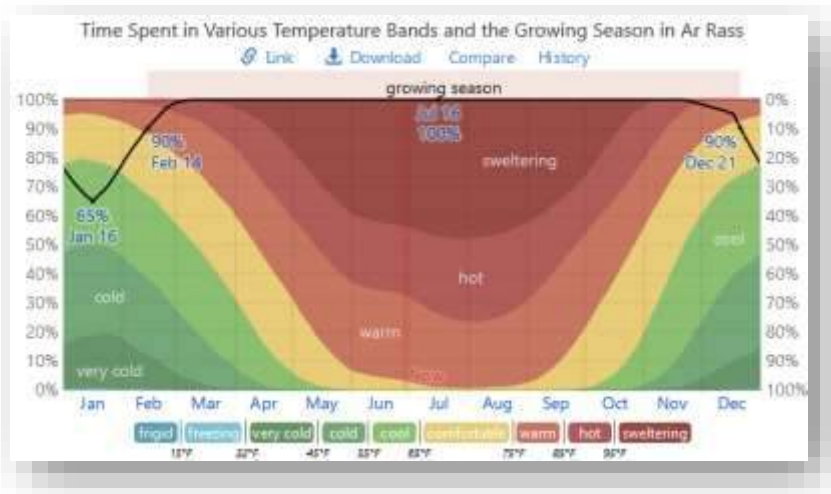


Methodology

For each hour between 8:00 AM and 9:00 PM of each day in the analysis period (1980 to 2016), independent scores are computed for perceived temperature, cloud cover, and total precipitation. Those scores are combined into a single hourly composite score, which is then aggregated into days, averaged over all the years in the analysis period, and smoothed. Our cloud cover score is 10 for fully clear skies, falling linearly to 9 for mostly clear skies, and to 1 for fully overcast skies. Our precipitation score, which is based on the three-hour precipitation centered on the hour in question, is 10 for no precipitation, falling linearly to 9 for trace precipitation, and to 0 for 0.04 inches of precipitation or more. Our tourism temperature score is 0 for perceived temperatures below 50°F, rising linearly to 9 for 65°F, to 10 for 75°F, falling linearly to 9 for 80°F, and to 1 for 90°F or hotter. Our beach/pool temperature score is 0 for perceived temperatures below 65°F, rising linearly to 9 for 75°F, to 10 for 82°F, falling linearly to 9 for 90°F, and to 1 for 100°F or hotter.

Growing Season

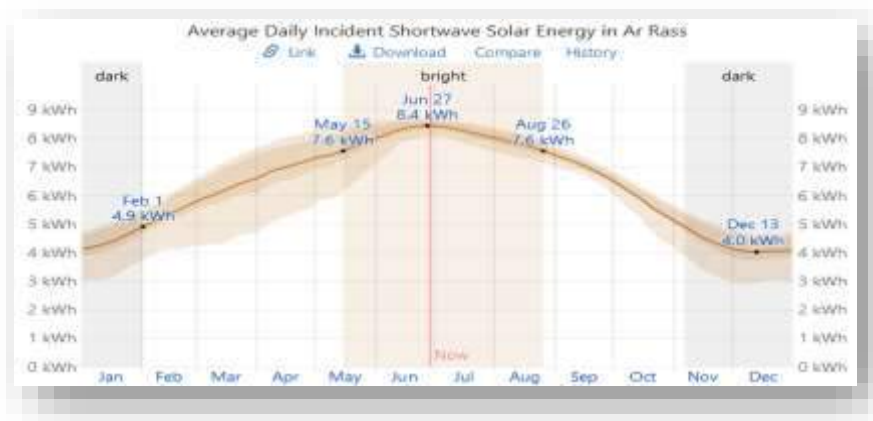
Definitions of the growing season vary throughout the world, but for the purposes of this report, we define it as the longest continuous period of non-freezing temperatures ($\geq 32^{\circ}\text{F}$) in the year (the calendar year in the Northern Hemisphere, or from July 1 until June 30 in the Southern Hemisphere). While it does not do so every year, freezing temperatures are seen in Ar Rass over some winters. The day least likely to be in the growing season is January 16, with a 65% chance.



Growing degree days are a measure of yearly heat accumulation used to predict plant and animal development, and defined as the integral of warmth above a base temperature, discarding any excess above a maximum temperature. In this report, we use a base of 50°F and a cap of 86°F .



Based on growing degree days alone, the first spring blooms in Ar Rass should appear around *January 12*, only rarely appearing before *January 9* or after *January 17*



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Solar Energy (kWh)	4.4	5.4	6.2	7.0	7.6	8.3	8.2	7.7	7.0	5.8	4.5	4.1

Topography

For the purposes of this report, the geographical coordinates of Ar Rass are 25.869 deg latitude, 43.497 deg longitude, and 2,267 ft elevation.

The topography within 2 miles of Ar Rass contains only modest variations in elevation, with a maximum elevation change of 164 feet and an average elevation above sea level of 2,258 feet. Within 10 miles also contains only modest variations in elevation (436 feet). Within 50 miles contains only modest variations in elevation (2,313 feet).

Data Sources

This report illustrates the typical weather in Ar Rass, based on a statistical analysis of historical hourly weather reports and model reconstructions from January 1, 1980 to December 31, 2016.



Temperature and Dew Point

There are 2 weather stations near enough to contribute to our estimation of the temperature and dew point in Ar Rass

4.3 Topography

Name: Ar Rass topographic map, elevation, relief.

Coordinates: 26.84070 49.49322 27.16070 49.81322

Minimum elevation: -14 ft

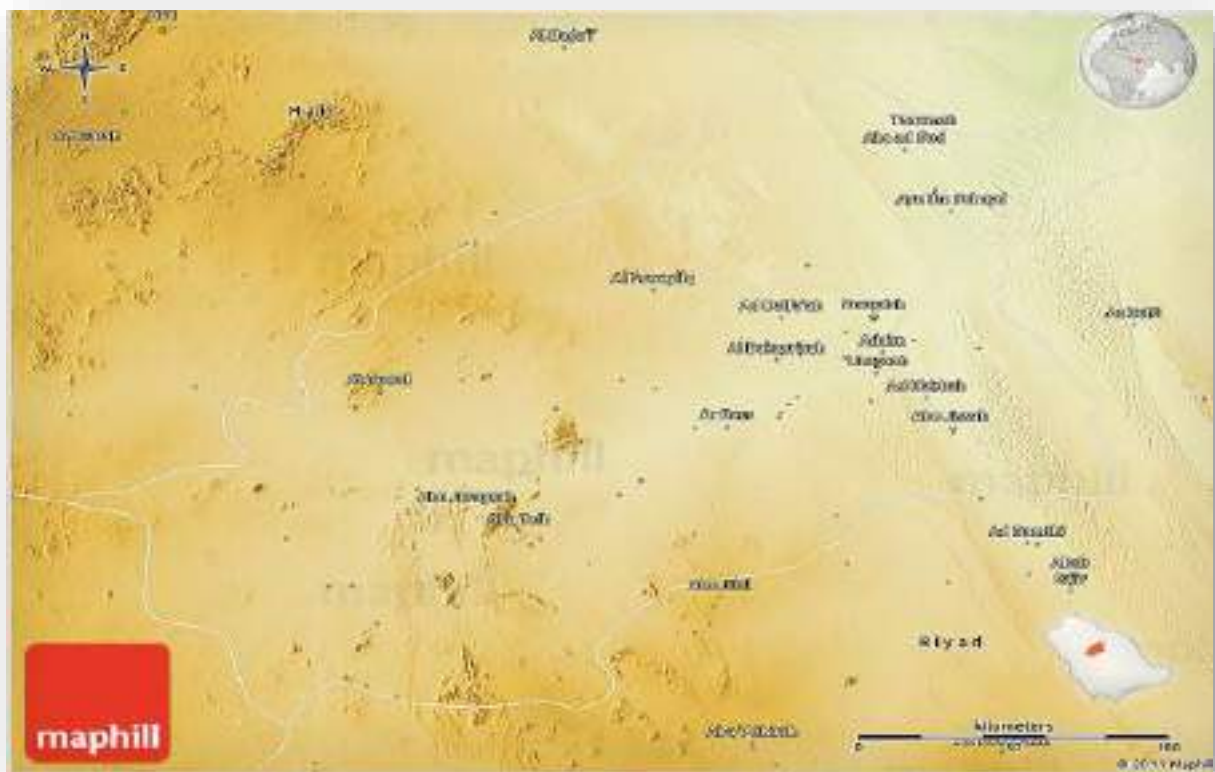
Maximum elevation: 306 ft

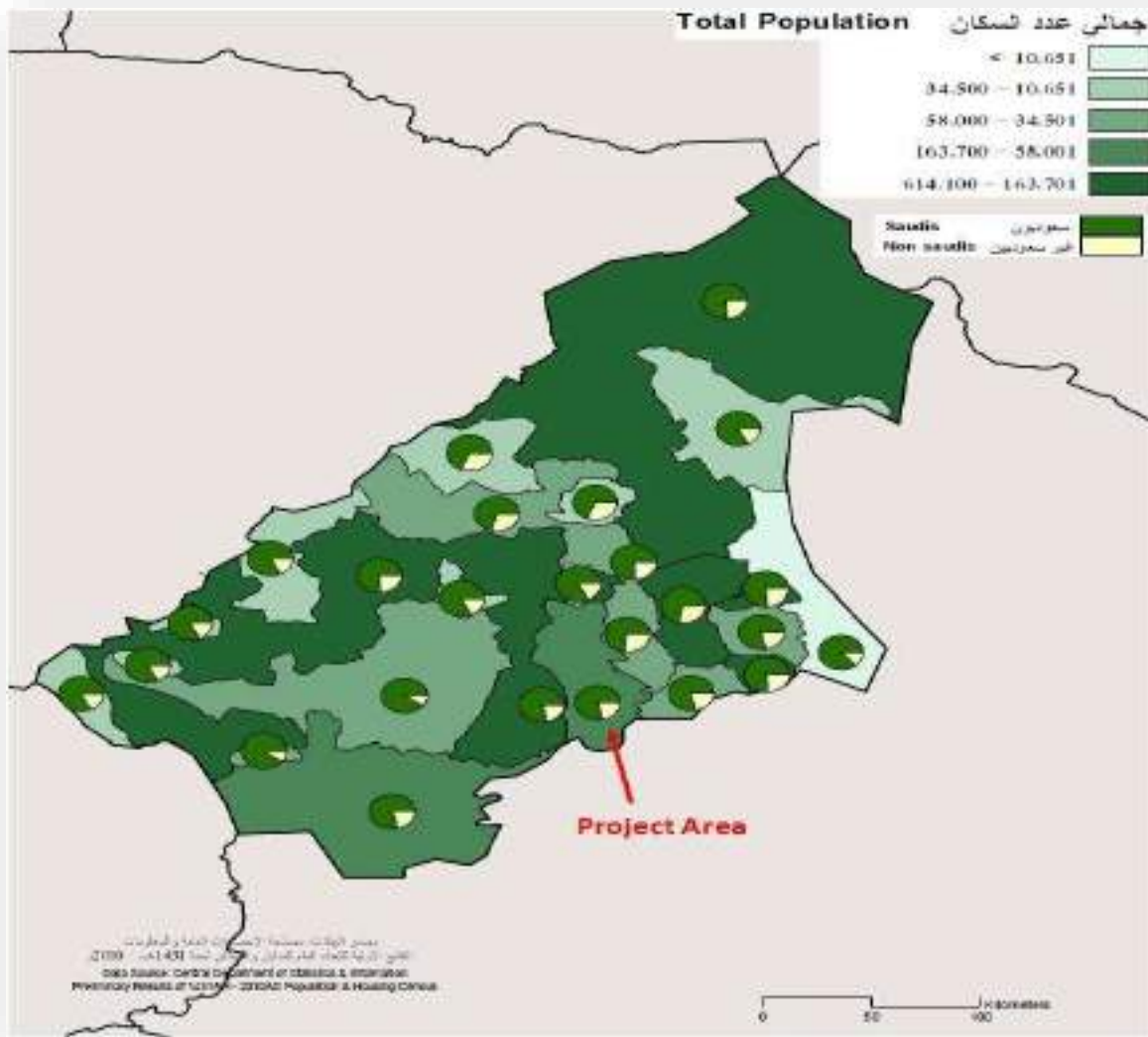
Average elevation: 16 ft

Barometric Pressure: 101KPa

Topography

For the purposes of this report, the geographical coordinates of Ar Rass are 24.688 deg latitude, 46.722 deg longitude, and 2,008 ft elevation. The topography within 2 miles of Ar Rass contains only modest variations in elevation, with a maximum elevation change of 200 feet and an average elevation above sea level of 2,004 feet. Within 10 miles contains only modest variations in elevation (617 feet). Within 50 miles contains significant variations in elevation (2,362 feet). The area within 2 miles of Ar Rass is covered by artificial surfaces (100%), within 10 miles by artificial surfaces (89%), and within 50 miles by bare soil (93%).



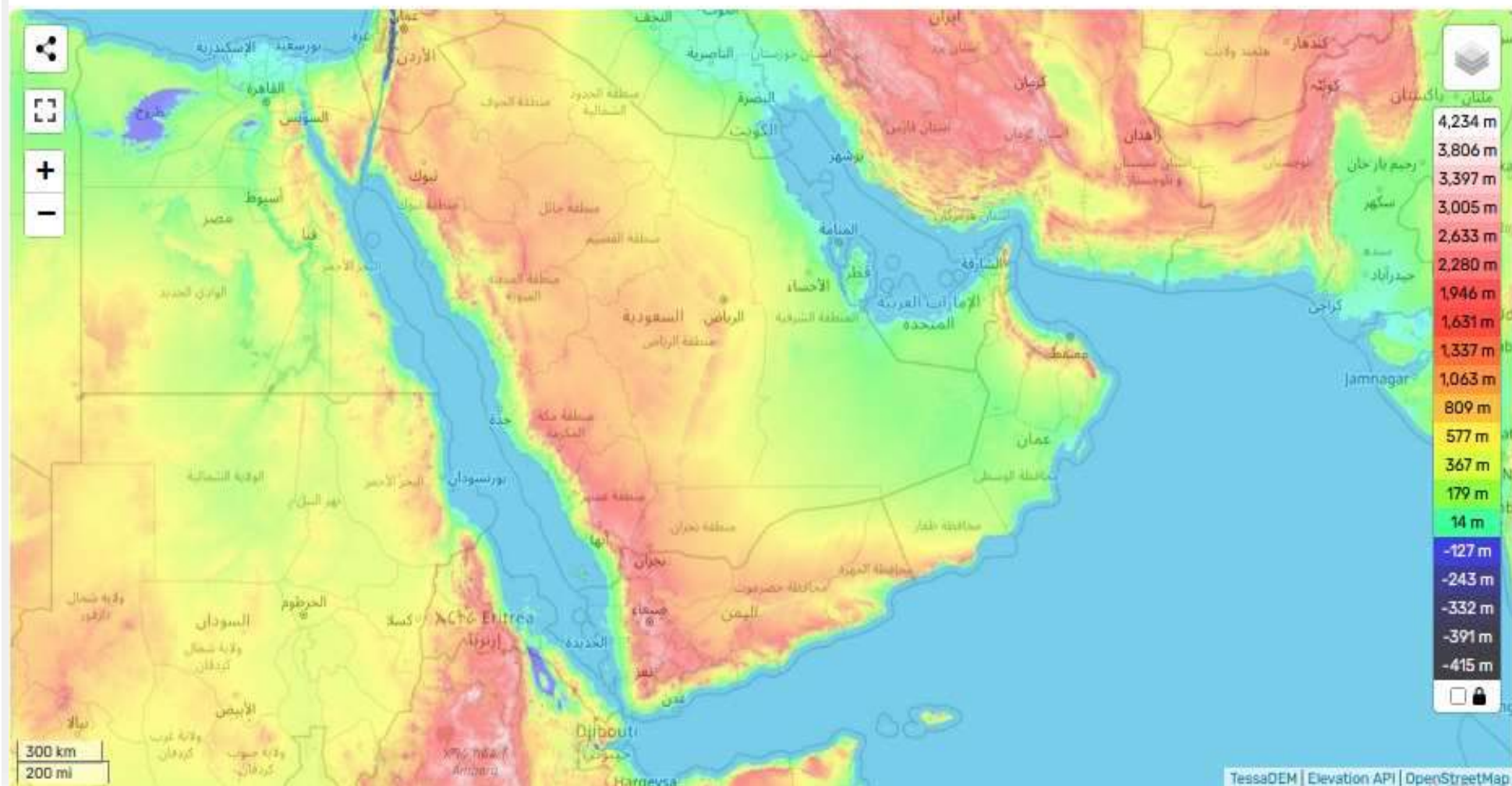






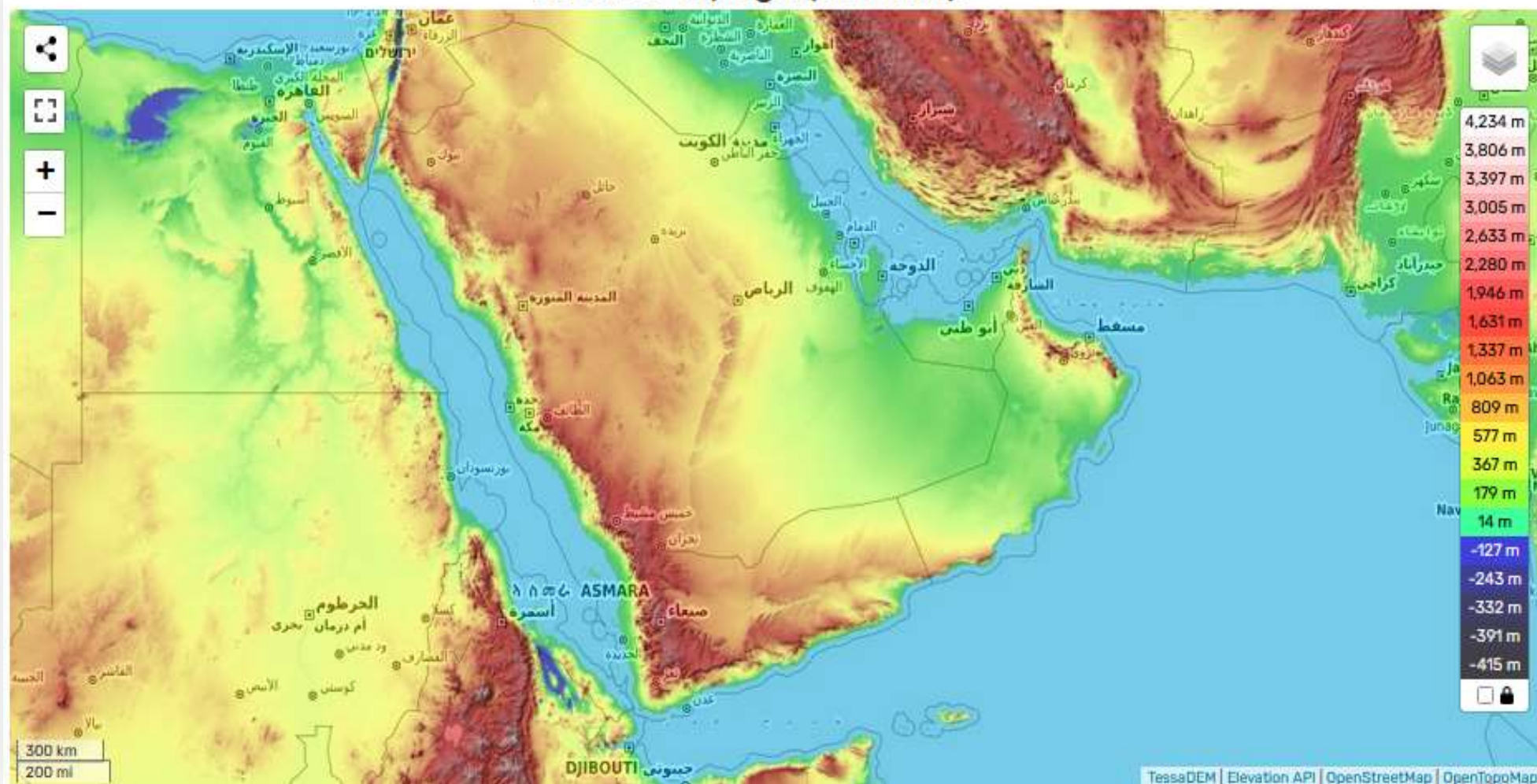


Ar Rass topographic map



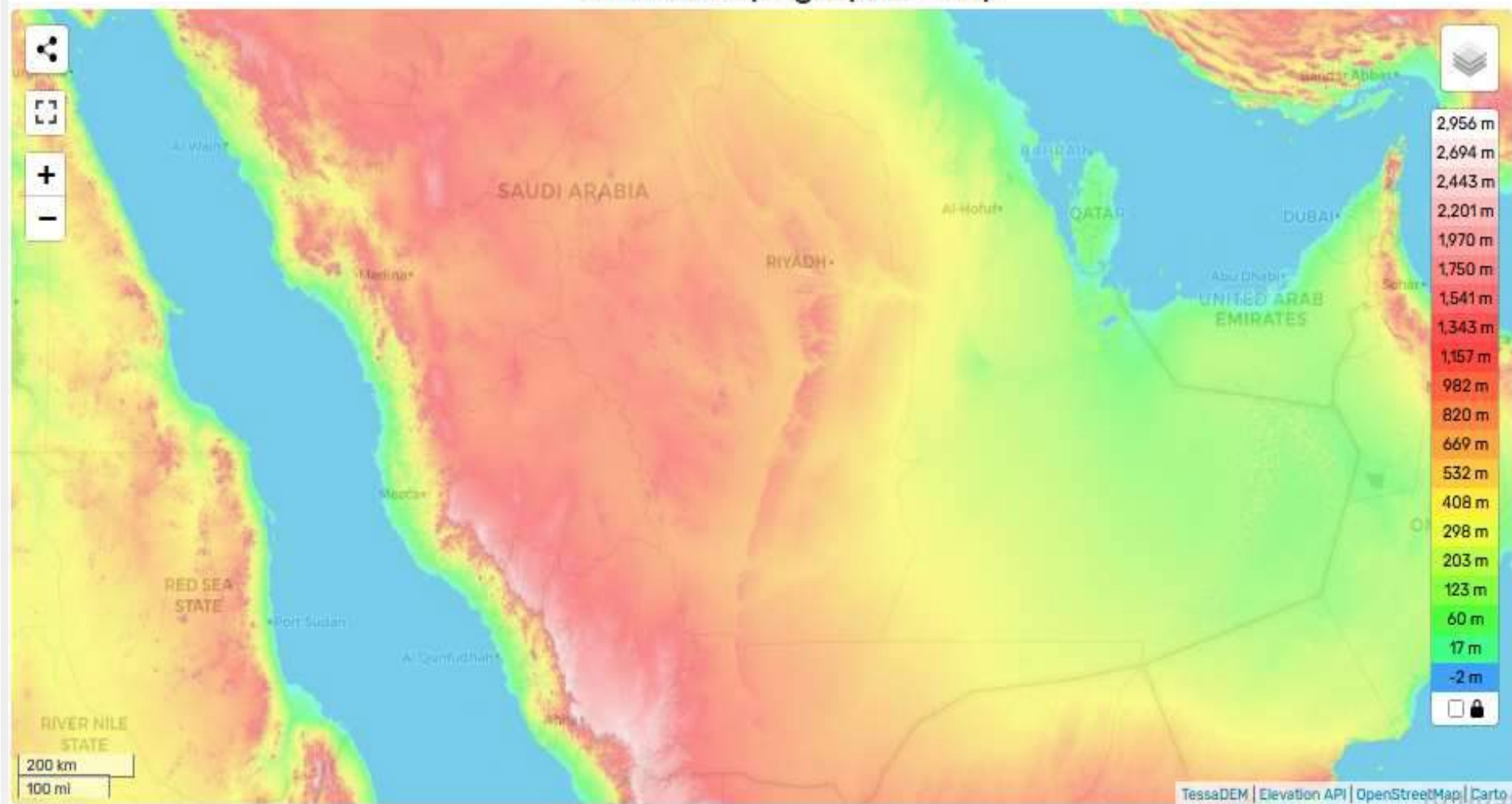


Ar Rass topographic map



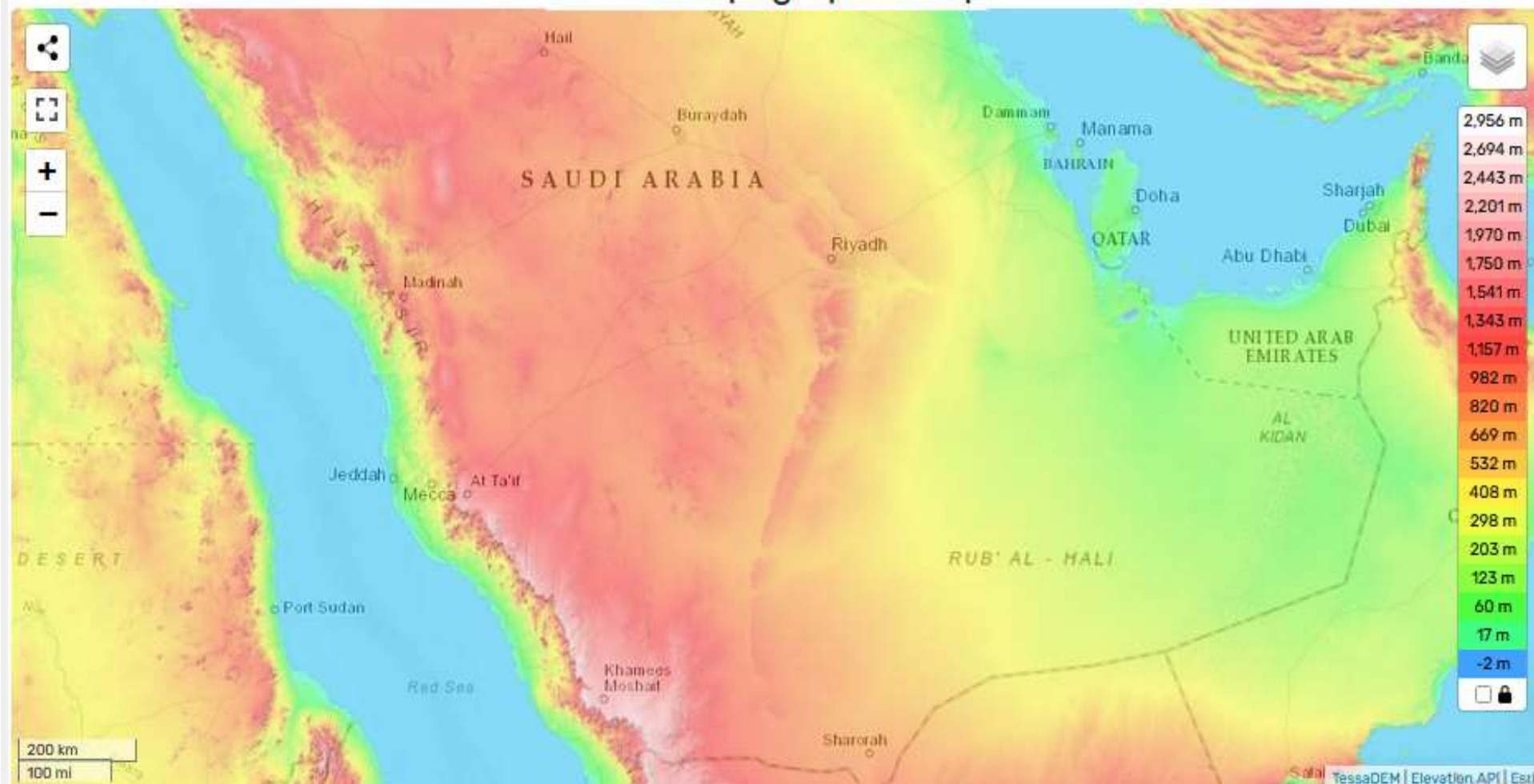


Ar Rass topographic map



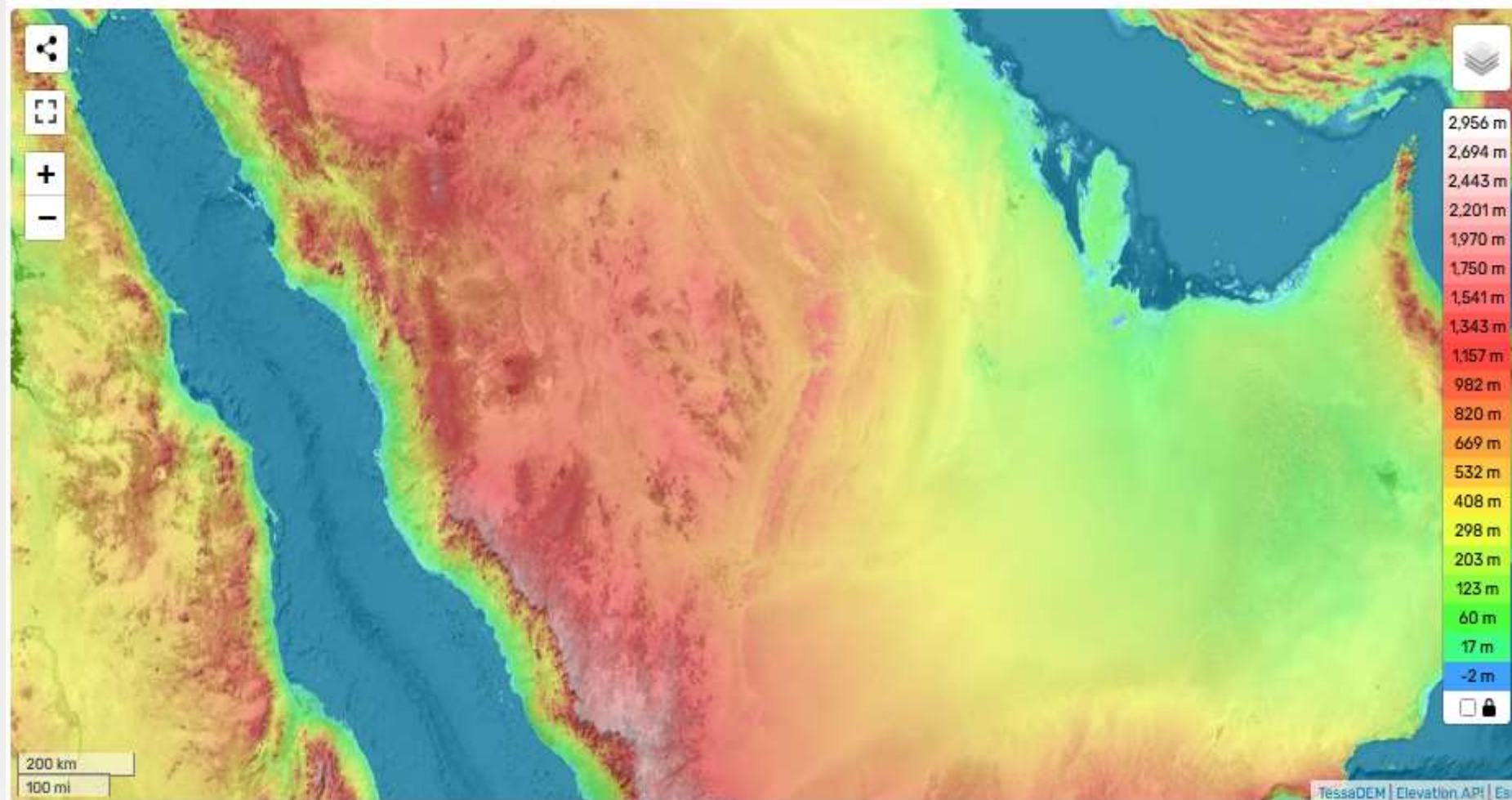


Ar Rass topographic map



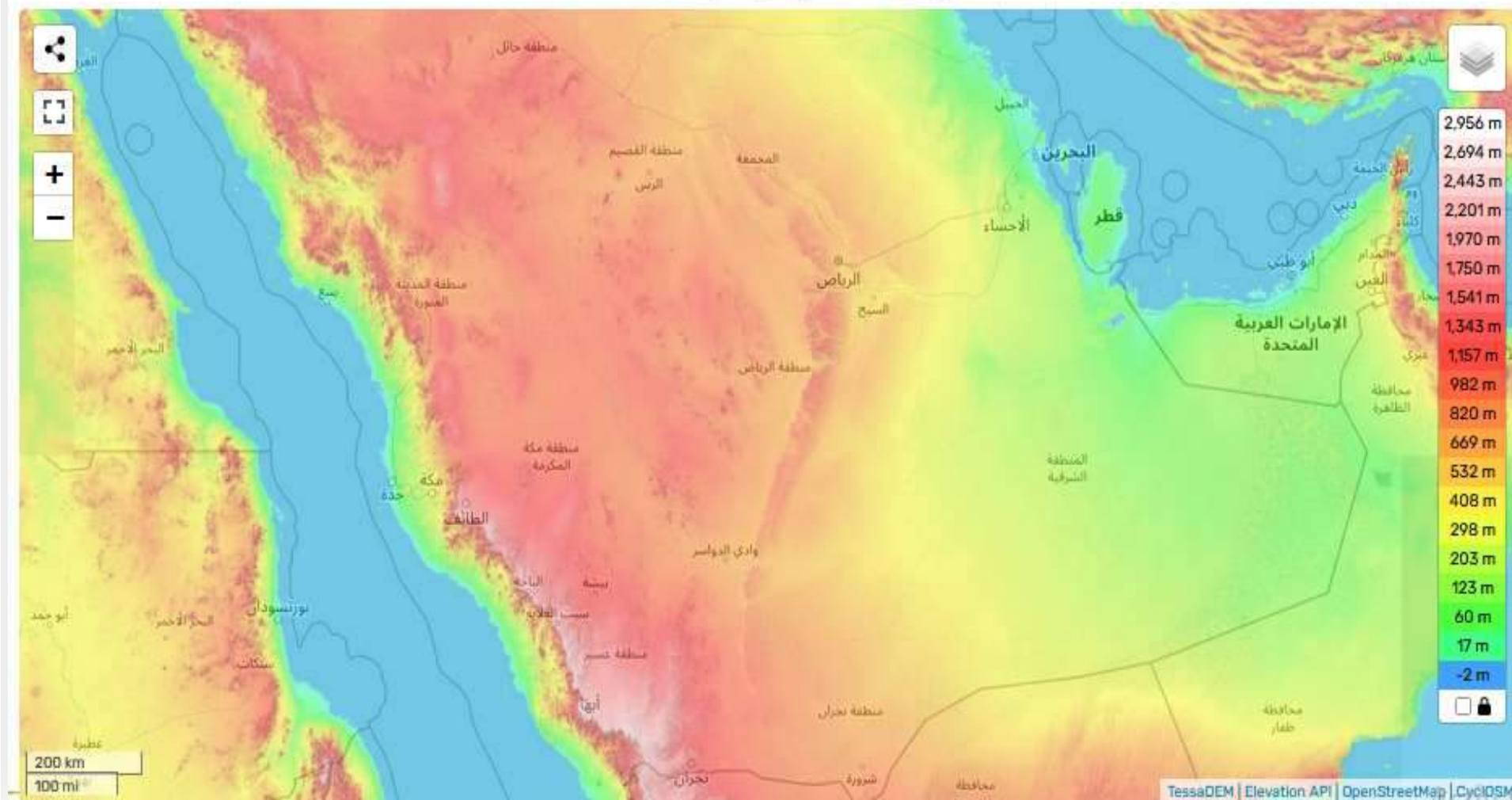


Ar Rass topographic map





Ar Rass topographic map



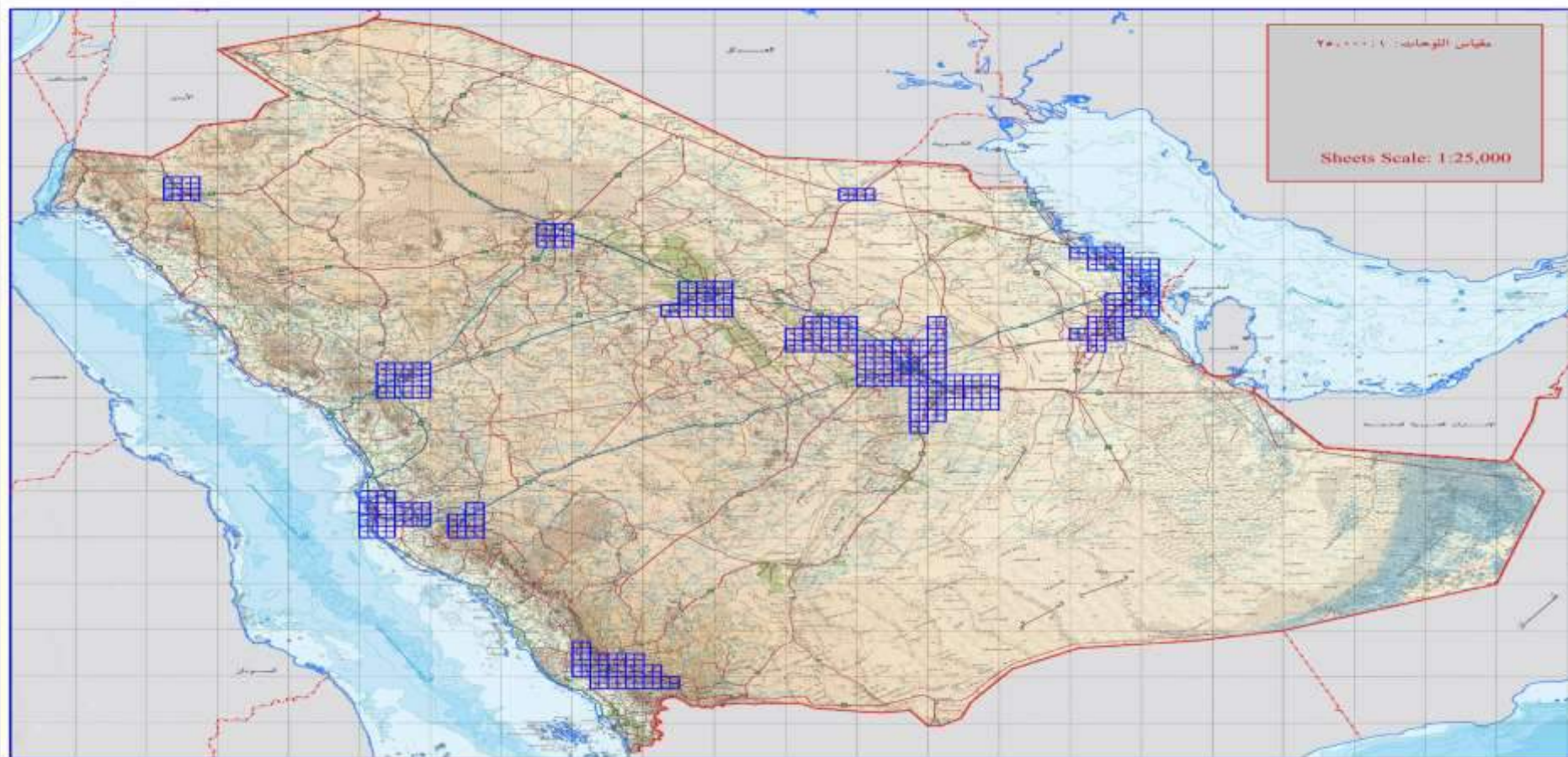


Figure 4-10 Topographic Map of Ar Rass



4.5 Air Quality

4.5.1 Introduction to Air Quality

A suspended particulate matter PM_{10} , and some gases such as Carbon Monoxide and Sulfur Dioxide, Nitrogen Oxides, Ozone and Hydrogen Sulfide are the most important indicators to study the atmospheric ambient air quality, and the noise intensity has a negative impact on humans and the environment at high levels.

In this report, the results of Environmental measurements that have been made for Three days, from 26/27 March 2023 for Ar Rass Solar Plant Project (figure 4-13) and comparing it with maximum limits allowed by the National Center for Environmental Compliance (NCEC).



Figure.1. Part of AR-SIPVPP Project.

4.5.2 Site Description

AR-SIPVPP site is located at the Central part of Saudi Arabia. The site is located at the coordinates: are shown in the Map.



Figure 4-14. Study Area

4.5.3. Objectives

The objectives of this report are:

Identify measuring data for Particulate Matter PM_{10} , Sulphur dioxide SO_2 , Nitrogen dioxide NO_2 , Carbon monoxide CO , Ozone O_3 , Hydrogen sulphide H_2S , and Noise.

This information will be helpful to understanding the Environmental Situation of the Project site.

4.5.4 Methodology and Monitoring process

4.5.4.1 Methodology Applied in Particulate Matter PM_{10}

Particulate matter PM_{10} measurement was carried out at the Project area by using the Greentech Fine Particulate SAMPLER GTI – 131 MFC shown in figure 4-15 and 4-16.

GTI – 131 MFC $PM_{10}/PM_{2.5}$ Sampler is constituted of high finished anodized Impactors which are well designed for the sampling of PM_{10} as well as $PM_{2.5}$.

Design of both Impactors is adopted from published USEPA design. Design of Impactors is for air flow rate of $1m^3/hr$ or 16.7 Lpm. This flow rate required to be constant at $16.7 \pm 5\%$ model GTI – 131 MFC uses a Diaphragm pump that produce needed suction. A microprocessor-based flow controller maintains constant sampling flow rate at 16.7 lpm throughout sampling duration In the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project the GTI – 131 MFC Sampler is used for the measurement of PM_{10} .



Figure 4-15. PM₁₀ Measurement

- **Location -1:** PM₁₀ measurement were carried out for 24 hours at the first location. It is located inside the project site with latitude and longitude coordinates as shown in the Map.
- **Second location:** PM₁₀ measurement were carried out for 24 hours at the second location. It is located inside the project site as shown in the Map

4.5.4 Methodology Applied in Ambient Air Gases (SO₂, NO₂, CO, O₃, H₂S)

Ambient Air Gases measurements were carried out at the site by using the SO₂, NO₂, CO, O₃, and H₂S Analyzers installed in the mobile laboratory.

4.5.4.1 Serinus 50 Sulfur Dioxide Analyzer

Automated Equivalent Method: EQSA-0809-188

Sulphur Dioxide Analyzer

The **Serinus 50** Sulphur Dioxide Analyzer uses UV fluorescent radiation technology to detect Sulphur dioxide in the range of 0-20 ppm.

The Serinus 50 measures SO₂ with the following components and techniques:

- Hydrocarbon kicker
- UV lamp
- Fluorescence cell
- Optical band pass filters
- Photomultiplier tube (PMT)



A microprocessor programmed with Serinus firmware monitors the detector response and many other parameters. The SO₂ concentrations are automatically corrected for gas temperature and pressure changes and when using gravimetric units (e.g. µg/m³) is referenced to 0°C, 20°C or 25°C at 1 atmosphere. This allows the Serinus 50 to provide readings in the relevant units for your requirements.

Measurement

Range

0-20 ppm auto ranging

USEPA designated range: 0-0.5 ppm

TUV EN certification range: 0 to 400 ppb

Lower detectable limit: 0.3 ppb, with Kalman filter active

Precision/Accuracy

Precision 0.5 ppb or 0.15 % of reading, whichever is greater

Linearity ±1 % of full scale (from best straight-line fit)

Noise at Zero < 0.15 ppb: **Response Time** 60 seconds to 95 %: **Sample Flow Rate** 0.750 slpm.

4.5.4.2 Serinus 10 Ozone Analyzer

Automated Equivalent Method: EQOA-0809-187

Ozone Analyser

The **Serinus 10** Ozone Analyzer uses non-dispersive ultraviolet (UV) absorption technology to measure ozone to a sensitivity of 0.5ppb in the range of 0-20ppm. The Serinus 10 measures O₃ with the following components and techniques:

- Mercury vapor lamp – to generate UV light at a wavelength that ozone will absorb (254nm).
- Photodiode detector – to capture the measurement response. Detects the remaining UV light after absorption, leading to the concentration of ozone.
- Ozone scrubber – to establish the background response. As ozone is not the only atmospheric gas that absorbs this particular wavelength of UV light.

A microprocessor programmed with Serinus firmware monitors the detector response and many other parameters. The O₃ concentrations are automatically corrected for gas temperature and pressure changes and when using gravimetric units (e.g. µg/m³) is referenced to 0°C, 20°C or 25°C at 1 atmosphere

The U.S. EPA has designated the Serinus 10 Ozone Analyzer as an equivalent method and SIRA has designated it as an EN approved instrument.

Measurement



Range

0-20 ppm auto ranging

USEPA designated range: 0-0.5 ppm

TUV EN certification range: 0 to 250 ppb

Lower detectable limit: 0.5 ppb, with Kalman filter active

Precision/Accuracy

Precision 0.5 ppb or 0.2 % of reading, whichever is greater:

Linearity <1 % of full scale: **Noise at Zero** <0.25 ppb: **Response Time** 30 seconds to 95 %:

Sample Flow Rate 0.5 slpm:

4.5.4.3 Serinus 30 Carbon Monoxide Analyzer

Automated Reference Method: RFCA-0509-174

Carbon Monoxide Analyzer

The **Serinus 30** Carbon Monoxide Analyzer is used to measure CO in ambient air, in the range of 0-200ppm. The Serinus 30 measures CO using the following components:

- Microprocessor control
- Proven Gas Filter Correlation (GFC)
- Combined with Non-Dispersive Infrared Spectrophotometer (NDIR) technology

A microprocessor programmed with Serinus firmware monitors the detector response and many other parameters. The CO concentrations are automatically corrected for gas temperature and pressure changes and when using gravimetric units (e.g. $\mu\text{g}/\text{m}^3$) is referenced to 0°C, 20°C or 25°C at 1 atmosphere. This allows the Serinus 30 to provide readings in the relevant units for your requirements.

Measurement

Range

0-200 ppm auto ranging

USEPA designated range: Any full-scale range between 0-50 ppm

TUV EN certification range: 0-100 ppm

Lower detectable limit: 0.04 ppm (40 ppb), with Kalman filter active

Precision/Accuracy

Precision 20 ppb or 0.1 % of reading, whichever is greater: **Linearity** Better than ± 1 % of full scale (0-50 ppm); ± 2 % of full scale (0-200 ppm), from best straight-line fit:

Noise at Zero 0.02 ppm:

Response Time 60 seconds to 95 %:

Sample Flow Rate 1.0 slpm:

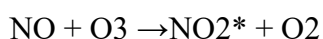


4.5.4.4 Serinus 40 Oxides of Nitrogen Analyzer

Automated Reference Method: RFNA-0809-186

Oxides of Nitrogen Analyzer - gas phase Chemiluminescence. The measurement of the Oxides of Nitrogen is performed using the gas phase Chemiluminescence method:

Sample air enters the reaction cell via two separate (alternating) paths; the NO and NOX channels. NO in the first path reacts with ozone according to the following reaction



The second path travels through a delay loop and the NO₂ to NO converter such that it reaches the reaction cell after the first path. At which point the NO_x measurement (the combined concentration of NO and NO₂) is taken. The concentration of NO₂ is then calculated by subtracting the NO measurement from the NO_x measurement. The concentration of NO₂ is calculated by subtracting the NO measurement from NO_x measurement $\text{NO}_x = \text{NO} + \text{NO}_2$ or $\text{NO}_2 = \text{NO}_x - \text{NO}$.

Measurement

Range

0-20 ppm auto ranging

USEPA designated range: 0-0.5 ppm

TUV EN certification ranges: NO (0 to 1,000 ppb) NO₂ (0 to 260 ppb)

Lower detectable limit: 0.4 ppb, with Kalman filter active

Precision/Accuracy

Precision 0.4 ppb otherwise 0.5 % of reading, whichever is greater:

Linearity ±1 % of full scale: **Response Time** 15 seconds to 90 %:

Sample Flow Rate 0.3 slpm (0.6 slpm total flow for the NO and NO_x flow path)

4.5.4.5 Serinus 51 Sulfur Dioxide and Hydrogen Sulfide Analyzer

The Serinus 51 SO₂/H₂S Analyzer uses UV fluorescent radiation technology to detect Sulfur Dioxide and Hydrogen Sulfide to a sensitivity of 0.5 ppb in the range of 0-2 ppm.

H₂S is measured by first scrubbing the SO₂ out of the sample with a selective SO₂ scrubber and converting the remaining H₂S into SO₂ with a thermal converter. The sample is drawn into the reaction cell where it is measured as SO₂.

A charcoal scrubber creates H₂S and SO₂ free air which is used to provide background corrections and in the hydrocarbon kicker to remove hydrocarbons from sample air.

The UV lamp is a discharge zinc lamp which emits UV radiation over a broad range. The band pass filter only allows UV at 214nm through into the cell. The optical band pass filter is a colored glass that only allows light of a specific wavelength through to the PMT (310 to 350nm). The



Sulfur Dioxide scrubber is a selective scrubber that captures SO_2 but allows H_2S to continue through to the internal converter. The internal converter uses high temperatures (300°C) and a catalyst to convert any H_2S in the sample to SO_2 . This conversion is used for H_2S measurements, on sample air which has previously had the SO_2 portion scrubbed from it. The measurement range of the Analyzer is 0-2 ppm auto ranging and lower detectable limit: <0.5 ppb or 0.2 % of concentration reading, whichever is greater, with Kalman filter active.

Two readings were taken at two selected locations for the measurements of two consecutive days for the duration 24 hours each, in which the sample locations were selected according to the nature of site (Figure 4-17) as described as follows:



Figure 4-17. Measurement of Ambient Air

- Ambient Gases measurements were carried out for 24 hours at the first location. It is located inside the project site as shown in the Map.

4.5.6 Monitoring Results

4.5.6.1 Particulate matter PM_{10}

As mentioned earlier, two readings were taken in two locations for 24 hours per site. The following table (Table 4-1) shows the results of the average concentration of Particulate matter 10 particles over 24 hours, where the concentrations of PM_{10} particles in the first location was $41.93 \mu\text{g}/\text{m}^3$ and the second location was $91.97 \mu\text{g}/\text{m}^3$.



Table 4-1-Hour average concentration particulate matter 10 results

Dakkak Trading Group

Owner: Abdulbade M.G. Dakkak

Commercial Registration 4030026530

Chamber of Commerce 7391

مجموعة مؤسسات الدقاق للتجارة والمقاولات
4030026530
الغرفة التجارية 7391

مجموعة مؤسسات الدقاق للتجارة والمقاولات

المالك: عبدالمجيد محمد جميل دقاق

الرجستر التجاري 40300004993

الغرفة التجارية 7391

Date: 3-04-2023

PM₁₀/PM_{2.5} Combo Air Sampler/279-2022

Project / Location: ARRASS SOLAR PV EPP

Name: Engr. Muroh Matar

Air Quality monitoring (PM ₁₀)	Date	Filter Name	Start Time	End Time	Duration	Start Time	End Time	Duration	Weight (Wi)									
Oven @ 103 °C																		
Desiccator																		
Weight (Wf)																		
By Difference																		
0.0084																		
Oven @ 103 °C																		
Desiccator																		
Weight (Wf)																		
By Difference																		
0.0097																		
By Difference																		
0.0013																		
Equation:																		
(Final weight of filter - Initial weight of filter) µg / Total Volume of Air m ³																		
Initial weight of filter:																		
98.4 mg																		
Final Weight of filter:																		
99.7 mg																		
Total Volume of Air Sampled:																		
23.89 m ³																		
PM ₁₀ Concentration Contained in the sampled Air:																		
54.42 µg/m ³																		

مجموعة مؤسسات الدقاق للتجارة والمقاولات
Source: Endress & Ziemer Air Quality Measurement Services, Supply and Maintenance, Monitoring Units of Meteorology Equipment and Environment Services de Indutec.

المالك: المهندس مورو مatar
الموقع: منطقة الدقاق في الدمام

Phone: 011-20000000

Fax: +966-11-20000000

P.O. Box: 3998 Jeddah 21571 Kingdom of Saudi Arabia

Email: info@dakkaktradinggroup.com

Phone: +966-11-20000000

Fax: +966-11-20000000

P.O. Box: 3998 Jeddah 21571 Kingdom of Saudi Arabia

NCEC Limit	التركيز µg/m ³	الموقع
340	54.42	موقع القياس

Comparing the levels of particulate matter PM₁₀ at monitoring locations and the maximum limits allowed by the National Centre for Environmental Compliance (NCEC), which is 340µg/m³. The results were less than the limit allowed by NCEC.

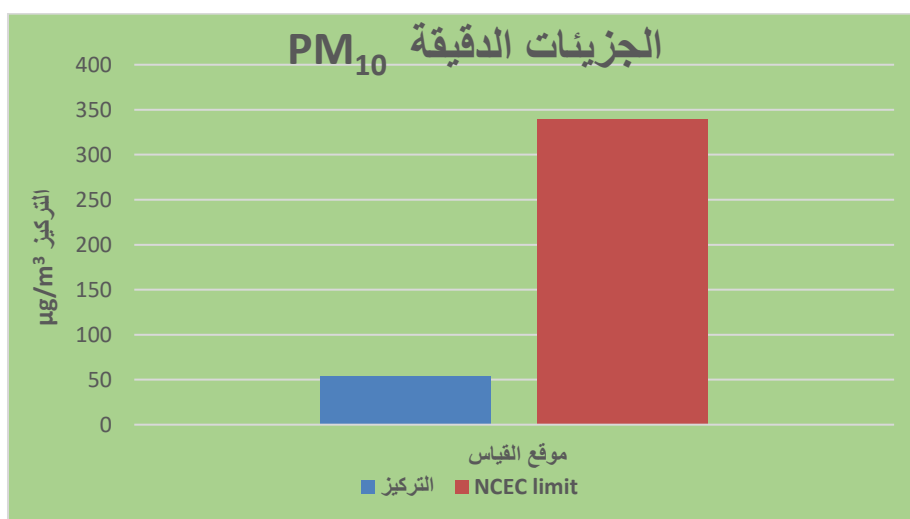


Figure 4-19: 24-hour average concentrations of PM₁₀ in comparison with the limits allowed by NCEC.



Green House Gases and Solar Power

As greenhouse gas emissions that contribute to global warming increase, it is becoming more important to consider the “carbon footprints” of Power and Water projects; however, the carbon footprints of water resource projects are often overlooked during environmental impact assessments. Notably, carbon releases occur when sea water is converted to fresh water and transported to industrial, agricultural, and residential areas for use, which consumes energy and materials. Several researches defined the carbon footprint concept in relation to water resources—the carbon emissions generated by acquiring one cubic meter of water—and estimates the carbon footprints for several water resource projects. The results show that the carbon footprint of China's south-to-north water diversion project decreased as the number of operating years increased. When the operation period reaches 30 years, the carbon footprint of China's south-to-north water diversion project will be about 0.179 kg CO₂. The carbon footprints for UAE desalination plants were 2.988 kg CO₂ for the multi-stage flash (MSF) method, 1.280 kg CO₂ for the multiple effect distillation (MED) method, and 2.562 kg CO₂ for the reverse osmosis (RO) method. These researches demonstrated that the calculation of carbon footprints for water resource projects can be a valuable source of information for decision-making involving water utilization and conservation.

Available technologies to mitigate GHG's

Solar desalination is a technique to produce water with a low salt concentration from sea-water or brine using solar energy. **There are** two common methods of solar desalination. Either using the direct heat from the sun or using electricity generated by solar cells to power a membrane process.

In the direct method, a solar collector is coupled with a distilling mechanism and the process is carried out in one simple cycle. Solar stills of this type are described in survival guides, provided in survival kits, and employed in many small desalination and distillation plants. Water production by direct method solar distillation is proportional to the area of the solar surface and incidence angle and has an average estimated value of 3–4 liters per square meter (0.074–0.098 US gal/sq ft). Because of this proportionality and the relatively high cost of property and material for construction direct method distillation tends to favor plants with production capacities less than 200 m³/d (53,000 US gal/d). Indirect solar desalination employs two separate systems; a solar collection array, consisting of photovoltaic and/or fluid based thermal collectors, and a separate conventional desalination plant. Production by indirect method is dependent on the efficiency of the plant and the cost per unit produced is generally reduced by an increase in scale. Many different plant arrangements have been theoretically analyzed, experimentally tested and in



some cases installed. They include but are not limited to multiple-effect humidification (MEH), multi-stage flash distillation (MSF), multiple-effect distillation (MED), multiple-effect boiling (MEB), humidification–dehumidification (HDH), reverse osmosis (RO), and freeze-effect distillation.

Indirect solar desalination systems using photovoltaic (PV) panels and reverse osmosis (RO) have been commercially available and in use since 2009. Output by 2013 is up to 1,600 liters (420 US gal) per hour per system, and 200 liters (53 US gal) per day per square meter of PV panel. Municipal-scale systems are planned. Utirik Atoll in the Pacific Ocean has been supplied with fresh water this way since 2010.

4.6 Noise Measurements

4.6.1 Introduction to Noise Measurements

The noise intensity has a negative impact on humans and the environment at high levels. The noise damage intensity on humans is influenced by several factors, including intensity and continuity of noise and the exposure duration to noise. The tests were carried out before the construction phase and comparing maximum limits allowed by the NCEC and will be consider this information as a reference for the construction and operational phase of the Solar PV Plant.

4.6.2 Methodology Applied in Noise

Noise measurements were carried out at the two locations by using two Pulsar Sound Level Meters.

Pulsar Sound Level Meter

Pulsar decibel reader use for environmental and industrial noise monitoring and provide either an automatic or manual sweep through the filter bands in a measurement duration of as little as 1 minute for the 1:1 Octave Band Filters. The frequency measurements are automatically time and date stamped with the 1:1 Octave Band Filters. Up to 12 days of 1 second time history can be stored. Weatherproof kits available for outdoor long-term monitoring

Features

A high performance integrating averaging sound level meter with additional key features including:

- Range 20dB(A) to 140dB(A) & 143dB(C)
- Real-time 1:1 Octave band filters
- TWA/dose and Ln values
- Data Logging and Analyzer Plus software
- Audio recording, Audio Note, and Automatic Timers



Applications: Ideal for compliant occupational, industrial, construction noise assessments and environmental noise pollution measurements

Environmental Noise Pollution measurement at its best

The Pulsar Model 45 Environmental Noise Meter is an extremely accurate, reliable, handheld precision instrument that is especially suited to measuring noise pollution. It successfully combines the latest technology in noise measurement methods with ease of use and durability. It can also be used for measuring noise across many different applications: noise at work, construction, entertainment, environment and for measuring machinery and vehicle noise. Compliant with IEC 61672-1:2002.

Noise measurement were carried out in the project sites using two Pulsar Sound Level Meters as shown in the following figures (4-34,4-35,4-36 and 4-37), Where four noise locations were taken in the study area. All four sites were measured for a period of 24 hours, as described as follows:

1. The first site - North: It is located on the border of the project from the northern side, with coordinates of latitude 25° 04' 31.08" north and longitude 47° 32' 58.61" east. The sample was taken in the day and night periods.
2. The second site - east: it is located on the project border from the eastern side, with coordinates of latitude 25° 04' 29.85" north and longitude 47° 34' 10.28" east. The sample was taken in the day and night periods.
3. The third site - South: It is located on the border of the project from the southern side, with coordinates of latitude 25° 01' 52.40" north and longitude 47° 36' 47.22" east. The sample was taken in the day and night periods.
4. The fourth site - West: It is located on the border of the project from the western side, with coordinates of latitude 25° 01' 58.79" north and longitude 47° 30' 36.41" east. The sample was taken in the day and night periods.



صورة 4-34. توضيح قياس الضوضاء في الموقع الثاني.



صورة 4-35. توضيح قياس الضوضاء في الموقع الأول.

Figure 4-34 Measurement of noise at the 1st location

Figure-4-35 Measurement of noise at the 2nd location



Figure 4-36 Measurement of noise at the 3rd location



Figure 4-37 Measurement of noise at the 4th location

The below figure shows sampling locations for PM10 fine particles, ambient air gases, and noise in the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass location map. (Figure 4-38).



Figure 4-38. Locations of PM10 fine particle samples, ambient gases, and noise.



4.6.3 Noise measurement

As previously explained, the noise intensity was measured at four sites for measurement periods for 24 hours each, the result of these measurements is shown in Table 4-3 below.

Table 4-3. Noise measurement results

الموقع	فترة القياس	Noise dB(Leq,)	معايير NCEC
الموقع الأول- شمال غرب	نهارا	50.9	70
	ليلا	43.1	65
الموقع الثاني-جنوب غرب	نهارا	52.3	70
	ليلا	47.9	65
الموقع الثالث-جنوب شرق	نهارا	54.0	70
	ليلا	30.2	65
الموقع الرابع-شمال شرق	نهارا	49.0	70
	ليلا	44.8	65

By comparing the measured noise intensity levels in all four locations in the study area, we find that it is less than the maximum permissible NCEC at all times, which is 70 decibels in the day and 65 decibels in the evening. The following figure (Figure 4-39) shows a comparison of the measured noise intensity at the four locations compared to the maximum permissible NCEC.

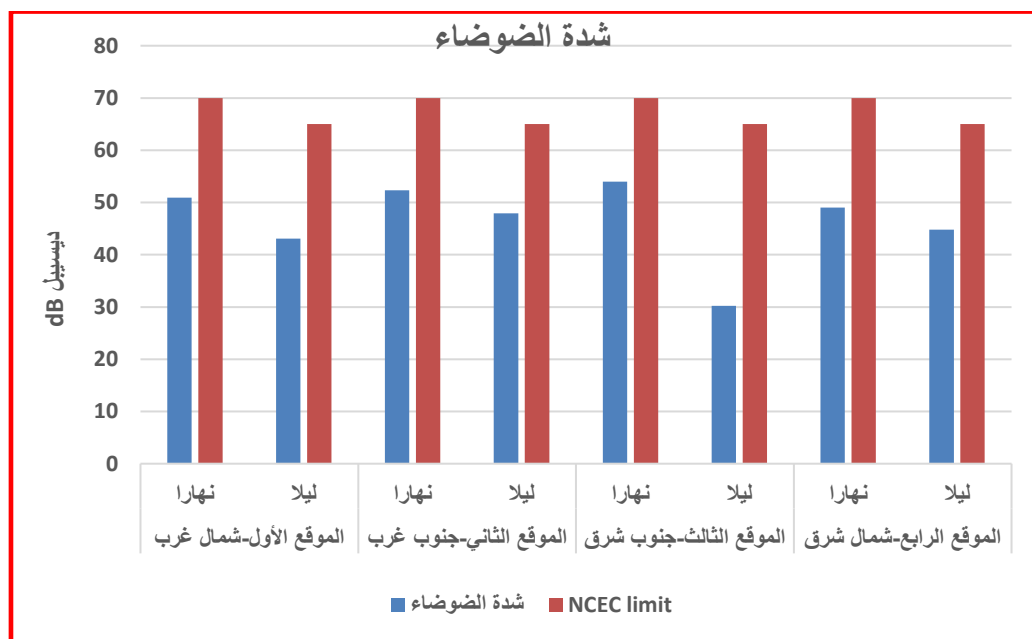


Figure.4-39. Noise Intensity at 4 different locations are compared to the limit allowed by NCEC



4.7 Geotechnical Investigation

4.7.1 Scope

This section presents Soil Classification for ground layers and analysis of the subsurface conditions at the site of the proposed Project to be located at Ar Rass, The Kingdom of Saudi Arabia. The purpose of this geotechnical investigation is to classify the subsurface layers formations and to set up one ground monitoring well. This section includes guidelines for site field investigation, laboratory observation, and subsurface formations.

4.7.2 Site Description

The site of proposed project is located at Ar Rass, Kingdom of Saudi Arabia. The investigated site surface is generally non-flat and the existing ground surface is covered by sandy soil.

4.7.3 Field Investigations

Borings:

After the visual inspection of the site, the subsurface soil investigation was performed by client. Monitoring wells number, location and depth were given by the Client's representative. Sampling conducted in accordance with ASTM standards.

In general, Split-spoon sampler samples and disturbed soil samples are recovered from various depths below the ground surface levels. Standard Penetration Test (S.P.T.) is usually conducted at intervals of 1.5 M mark with the use of 140lb. Hammer to recover samples in the split-spoon sampler. Rock quality designation (RQD) and total core recovery for rock samples are measured as well. The boreholes were drilled down to 10.0 M below the ground surface level.

Subsurface Formations

The well drilling, which was drilled and excavated down to the depth mentioned before, revealed that the subsurface formations at the site consist basically of the following layers:

Poorly graded SAND with silt:

As a top layer in the borehole, a layer of Grey up to wet poorly graded sand with mud was found. This layer extends down up to depths 3.0m.

Sandy CLAY:

As a subsurface layer below the above layer in the borehole a layer of Grey, fine & Damp to wet Sandy CLAY was found. This layer extends down up to depths 7.50 m.

Fat CLAY:

As a subsurface layer below the above layer in the borehole a layer of Grey, fine & wet Fat CLAY was found. This layer extends down up to depths 10.0 m which is the maximum depth of the borehole.

**** During the field investigation, no major underground cavities were found throughout the**



boreholes. It must be noted that the subsurface formation nature enhances the possibility of cavity formation since the latter is strongly related to the presence of limestone formation which actually does exist in the subsurface formation of proposed site.

** Ground water table was encountered throughout the borings during the time of drilling and one day after finishing field works and it was founded at depth from 3.50 m.

Terrestrial Ecological Survey

Ecology of the site

Introduction

The Kingdom of Saudi Arabia cover about 1,969,000 square kilometers, presenting two thirds of the Arabian Peninsula. The Kingdom is known to have a portions of two out of the eight known global terrestrial realms; namely the Palearctic and the Afrotropical. Also located along an important flyway between Eurasia and Africa, which give an important area for the diversity of migratory birds (Shobrak 2012). The Kingdom hosts several important habitat including freshwater wetlands, isolated mountain massifs, juniper woodlands, islands, sea grass beds, mangrove thickets, coral reefs, salt marshes, algal beds, acacia woodlands, rawdahs (meadows) and Wadis (valleys). Therefore with these biological diversity and productivity, these key biological sites, or hotspots, are probably fundamental in the synergistic framework of associated ecosystems (NCWCD 2005).

Therefore, Saudi Arabia represents an area of great ecological significance. To conserve these ecosystems and wild fauna and flora connected to these biological sites, the Kingdom of Saudi Arabia presented in the Saudi Wildlife Authority (SWA) develop a national strategy to contribute to protect the biodiversity. The strategy was prepared with the aims to integrating the conservation and sustainable use of biodiversity into the national planning process with all development programs (NCWCD 2005). The Strategy has identified seventeen Strategic Goals to encompass the various sectors: three strategic goals for the ex-situ and in-situ conservation of wildlife and wild habitats; two strategic goals for the sustainable use of woodlands and rangelands; three strategic goals for the conservation and sustainable use of living natural resources; nine general strategic goals that provide direct support to biodiversity. Part of the objectives set out in the plan covered several elements such as the protection of terrestrial, ecosystems through the establishment of protected areas. One of important goals of the strategy was to conserve and manage of biodiversity of wild fauna and flora outside protected areas partly through introducing of Environmental Impact Assessments (NCWCD 2005).

According to article five (5-1) in the general role of Environmental in Saudi Arabia issued 2006 by the Presidency of Meteorology and Environment (PME) now renamed as GAMEP and



again as NCEC which showed that agencies would like to develop an industrial project such as the new AR-SIPVPP they should carry out an Environmental Impact Assessment (EIA) study for the site. Therefore, it is essential for these to determine the ecological aspects of the site and the possible effect of the activities in the environment. However, one of the main components for the EIA study is the biodiversity occurring for the selected site.

In this report, the results of the biodiversity survey for AR-SIPVPP site is presented and discussed. The main objectives of the report are; to determine the biodiversity occurring (Fauna and Flora) in the site and to evaluate the possible impacts on terrestrial fauna and flora resulting from the activities of the proposed site for the project. Moreover, the basic landforms/habitat types occurring on the site will be identified.

Biodiversity of Saudi Arabia Flora

The 2250 species of flora in Saudi Arabia belong to 132 families and 837 genera. Out of these species 40 are considered endemic. However, the flora are facing several threats such as; degradation of rangelands; uncontrolled cutting of trees and shrubs; accelerated development programs; years of periodic drought; modern agricultural practices on virgin lands and loss of agricultural terraces.

Fauna

According to NCWCD (2005) there is probably 76 species of terrestrial mammals and 22 marine mammals occur in Saudi Arabia and about 444 bird species with 10 endemic species. As the Amphibians there are Seven native amphibian species restricted to freshwater seeps and ephemeral pools. As the reptiles, there are 55 species of snakes, 70 species of lizards and five species of marine turtles with two species the green and hawksbill turtle, which they nesting in the Saudi' marine territories. As the marine fishes; there are over 1280 species of fish have been recorded in the Red Sea and 542 species in the Arabian Gulf. As the freshwater fishes there are probably nine species most of them are endemic to the region.

Despite this large number of biodiversity, the fauna of the Kingdom faces several threats such as over-grazing and wood-cutting, overhunting, overfishing, loss of terrestrial, marine and freshwater habitats, urban expansion and human settlements, pollution of water sources, expansion in agricultural lands, introduce of invasive species, and indiscriminate use of pesticides.

The main goals of the studying the biodiversity of Ar Rass area as a part of Environmental Impact Assessment are to determine the main important biodiversity and possible threats to the species and their habitats at site especially with present plan for Ar Rass city development for the site. Moreover, habitats occurring at the site were identified and described

➤ Study site and Methodology



➤ Site Location and General Description

The site is located in the barren land located north east of Ar Rass Town

Biodiversity Survey Methodology

There is no information available on the ecology of this area, a desktop and qualitative surveys of the flora and fauna of were conducted. Photographs and observations by the Environmental Balance specialist team on the flora and fauna were taken to develop biodiversity report of the site.

During the survey we applied three methods to determine the species associated with habitats in various sites:

- Literature review.
- Random observations and quadrates

Literature review

There is limited information available derived from the previous literatures. The majority of articles and books covered the surrounding the site was reviewed such as the majority volumes of the Fauna of Saudi Arabia.

Random observations and quadrates

Due to the size of the site, and the limited time available to conduct the survey, it was necessary to drive around the site, stopping at natural vantage points. The information provided in this report is based on these rapid surveys, and describes the land use across the site. During the survey, a total of several stops were made. Landscapes were photographed as well as at the sample stops.

Fauna

A General surveys for the biodiversity were carried out by the Environmental Balance team during March 2023. The habitat and all fauna species observed at the site and adjacent areas were recorded and photographed. For detailed identification of the fauna, we used along with our knowledge and expertise; direct observations during random walking and driving at the site and adjacent areas. Moreover, literature review was used to confirm the sighting from the tracks and also determine the possible species occur at the site. For identification of species, we used Harrison (1972); Harrison and Bates (1991), Nader (1990) and Saudi Aramco (2017) for mammals, while the reptiles we used Egan for snakes and Saudi Aramco (2017) and Dahlawi and Sarhan (2015) for lizards. Whereas for birds we used del Hoyo and Collar (2014; 2016), Jennings (2010), Porter and Aspenal (2010). Finally, the IUCN red list status globally and regionally were used to determine the threaten species in the site (Mallon and Budd 2011; IUCN 2018).



Flora

Using the random observations method, all species observed within the project site and adjacent areas were recorded and photographed. A list of the annual, perennial and dominant species were recorded and identified. For field identifications we used several field identifications guides references such as; Collenette (1999), Migahid, (1978), Chaudhary (1999; 2000), and Boulos, (1999; 2000; 2002; 2005; 2009). The **DAFOR** scale was used to determine the relative abundance of each species as following: **D** = Dominant; **A** = Abundant, **F** = Frequent, **O** = Occasional, **R** = Rare.

The current laws of Saudi Arabia provide a comprehensive framework of legislation under which the Kingdom can fully meet its obligations as a signatory to the Convention on Biological Diversity (CBD). Table below presents presented the laws in the chronological order in which they were implemented.

According to article 5-1 of the General Environmental Regulations and Rules for Implementation of Kingdom of Saudi Arabia issued 2001 by the PME/NCEC which states that the developer should conduct an EIA for any development project. However, to carry out this study it is essential to determine the ecological aspects of the site and the possible effect of the activities in the environmental of site. Thus this ecological survey has been carried out and presents the initial results of biological survey to evaluate the possible impacts on terrestrial ecology from AR-SIPVPP project site with the following objectives:

- Flora – Diversity and abundance, Classification up to generic level
- Fauna – Diversity and abundance, Classification up to generic level

Table . Legislations pertaining to Biodiversity in Saudi Arabia

Title	Date
Agricultural and Veterinary Quarantine Regulations	1975
The Uncultivated Land Act	1978
The Forests and Rangelands Act	1979
The Water Resource Conservation Act	1980
The National Commission for Wildlife Conservation and Development Act	1986
The Fishing Exploitation and Protection of Live Aquatic Resources in the Territorial Waters of Saudi Arabia Act	1987
The Wildlife Protected Areas Act	1995
The Wild Animals and Birds Hunting Act	1999
The Act on Trade in Endangered Wildlife Species and their	2000
Environmental Code	2002

Ground truthing survey is the methodology to determine and to identify any present flora and fauna within the site. Parts of the activities are to document existing life forms habitat, environmental conditions and anthropogenic activities through 100x100 m² walkover



techniques. The team that conducted the survey was using GPS, camera and notebooks to record and documents all significant information around the site. Any species that the team could not identify in the field was collected as a sample for identification at the laboratory.

This terrestrial ecology survey has been undertaken from 03rd March 2023 4th March 2023 and identified flora and faunal species. The team observed few succulents/ xerophytes and shrubs, perennials and annuals typically associated with flat terrain, and AR-SIPVPP habitat. The project site is totally underdeveloped with dead remains of Camels, Sheep's, and Goats. Few grazing animals found in the surrounding areas.

The livestock population observed during the survey.

Table . General observation report

Tasks	Observations
Surface cover site (Sandy & Stoney desert, hard standing, scrub vegetation etc. potential for surface water infiltration)	Sandy flat /Terrain desert with vegetation composed of scrubs, creepers, and Succulents
Building and hard standing materials	None. The site is a barren land with Solid waste dumped at many places
Visible evidence of contamination (looked for vegetation dieback, discolored liquid)	➤ Used tires ➤ Building demolition waste ➤ Plastics ➤ Mixed Garbage ➤ Wooden materials ➤ Used furniture
Waste disposal	Many heaps of solid waste dumped in the AR-SIPVPP site
Presence of vegetation and invasive weeds	➤ Shrubs ➤ Xerophytes ➤ Bushes Comprising less than 5% of the total area
Presence of wildlife	A wild Fox, was observed during site visit
Livestock	Camels, Goats, sheep, Horses, Donkeys
Buildings/built structures on site • Presence of asbestos	None
Presence of station/transformers) PCBs (electrical sub stations)	None
Storage of materials/storage tanks	None
Atmospheric emissions	None
Services-overhead or buried services (overhead wires, sewers, effluent discharges, gas main, petrol interceptors, where do drain discharge to?) Are any surface water drains in sensitive	None
Site geology (surface outcrops/exposures of soils/rocks in any areas of excavations, drainage ditches, cutting etc.	



Site topography	Sandy & gravel terrain
Surface water bodies and courses	
Distance to nearest properties	4 Km
Observation on neighboring site	Barren land

The flora at the AR-SIPVPP site is very sparse. Estimated less than 5% of vegetation in the overall area of the project site, that mostly composed with grass and shrubs, with no trees were observed during the survey.

There were no evidences of Bedouin population found at AR-SIPVPP site. Solid waste heaps, borrow pits were observed. During the ecological survey, some sheep and camels were found to be foraging in the surrounding sites.

The survey team could find any animals during the survey .

The majority of the project site has been disturbed by the human activities, land filling and most of surrounding areas were partly covered by solid waste. However, three types of habitats were distinguished; sandy hummocks, open sandy gravel.

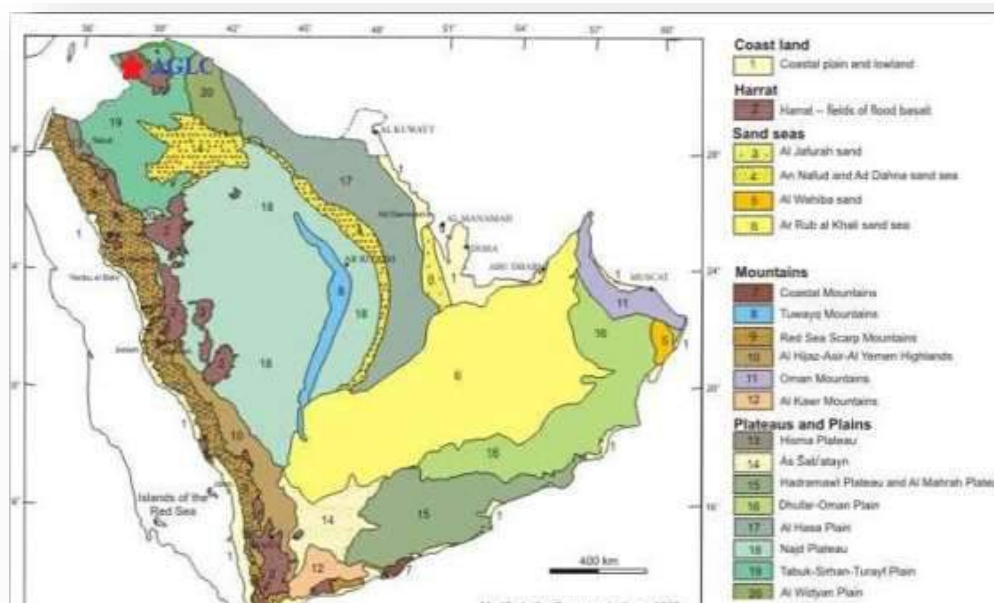


Figure: Soil Types near AR-SIPVPP

The Study Area is characterized by its sparse, patchy dwarf shrub vegetation, concentrated in small drainage lines, wadis and silty depressions. There are no trees, except for the occasional *Tamarix arborea* along large stream beds north of the proposed site. Dominant perennial shrub species include *Haloxylon salicornicum*, *Salsola* spp., *Artemisia* spp., *Achillea fragrantissima*,



Astragalus trimestris, *Zilla spinosa* and *Capparis spinosa* are abundant on the margins of silty depressions.

Plants:

- *Haloxylon persicum*
- *Calligonum comosum*
- *Haloxylon salicornicum*,
- *Salsola* spp.
- *Artemisia* spp.,
 - *Achillea fragrantissima*,
 - *Astragalus trimestris*.
 - *Zilla spinosa*
 - *Capparis spinosa*
 - *Calotropis procera*
 - *Panicum turgidum*
 - *Cocculus species*
 - *Cyperus* Sp
 - *Acacia* sp

None of the above Plant species are listed in IUCN Red list



Figure. *Haloxylon persicum*



Figure. *Calligonum comosum*



Figure. *Haloxylon salicornicum*



Figure. *Salsola spp*

- *Achillea fragrantissima*,
- *Astragalus trimestris*.
- *Zilla spinosa*
- *Capparis spinosa*
- *Calotropis procera*
- *Panicum turgidum*
- *Cocculus species*
- *Cyperus Sp*
- *Acacia sp*

None of the above Plant species are listed in IUCN Red list



Figure . *Haloxylon persicum*



Figure. *Calligonum comosum*



Figure Haloxylon salicornicum



Figure. Salsola spp



Figure. Zillaspinosa



Figure Capparisspinosa



Figure . Panicum turgidum



Figure . Calotropis procera

Table .Fauna

SI No	Common Name	Zoological Name
1	Goat	<i>Capra aegagrushircus</i>
2	Sheep	<i>Ovisaries</i>
3	Donkey	<i>Equusasinus</i>
4	Horse	<i>Equuscaballus</i>
5	Camel	<i>Camelus</i>
6	Cat	<i>Feliscatus</i>



7	Dog	<i>Canis lupus familiaris</i>
8	Wild Fox	<i>Vulpes vulpes</i>
9	Crested lark	<i>Galeridacristata</i>
10	Palestine sunbird	<i>Cinnyrisosea</i>
11	Stonechat	<i>Saxicolarubicola</i>
12	Isabelline wheatear	<i>Oenantheisabellina</i>

The existing plant communities observed near Ar Rass Power Plant project area during Terrestrial Ecological survey. Only few shrubs were found.

Environmental Sensitivity

Management - Protected Areas



ReefGIS Online Map

Figure: Map showing protected areas in KSA

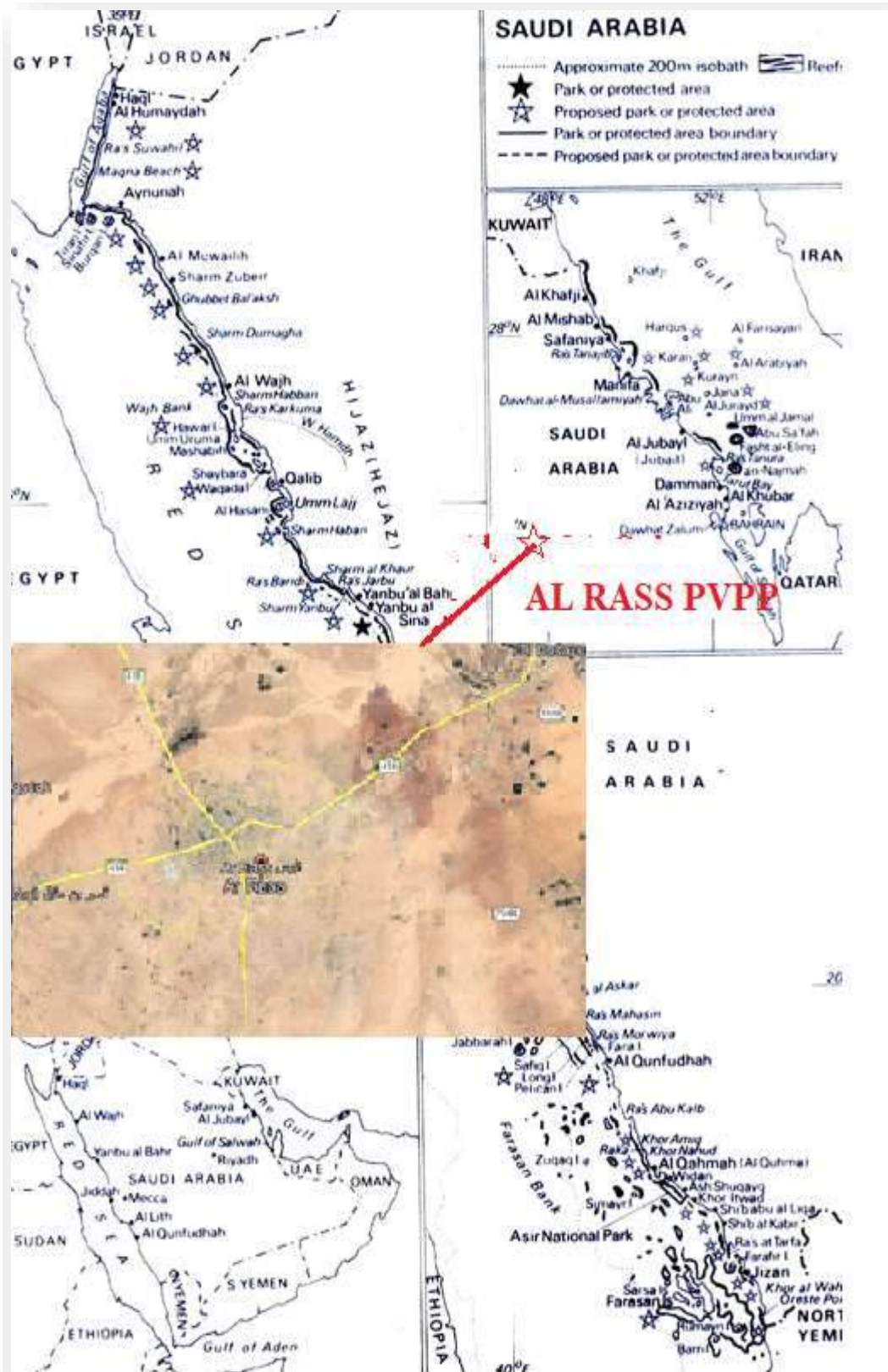
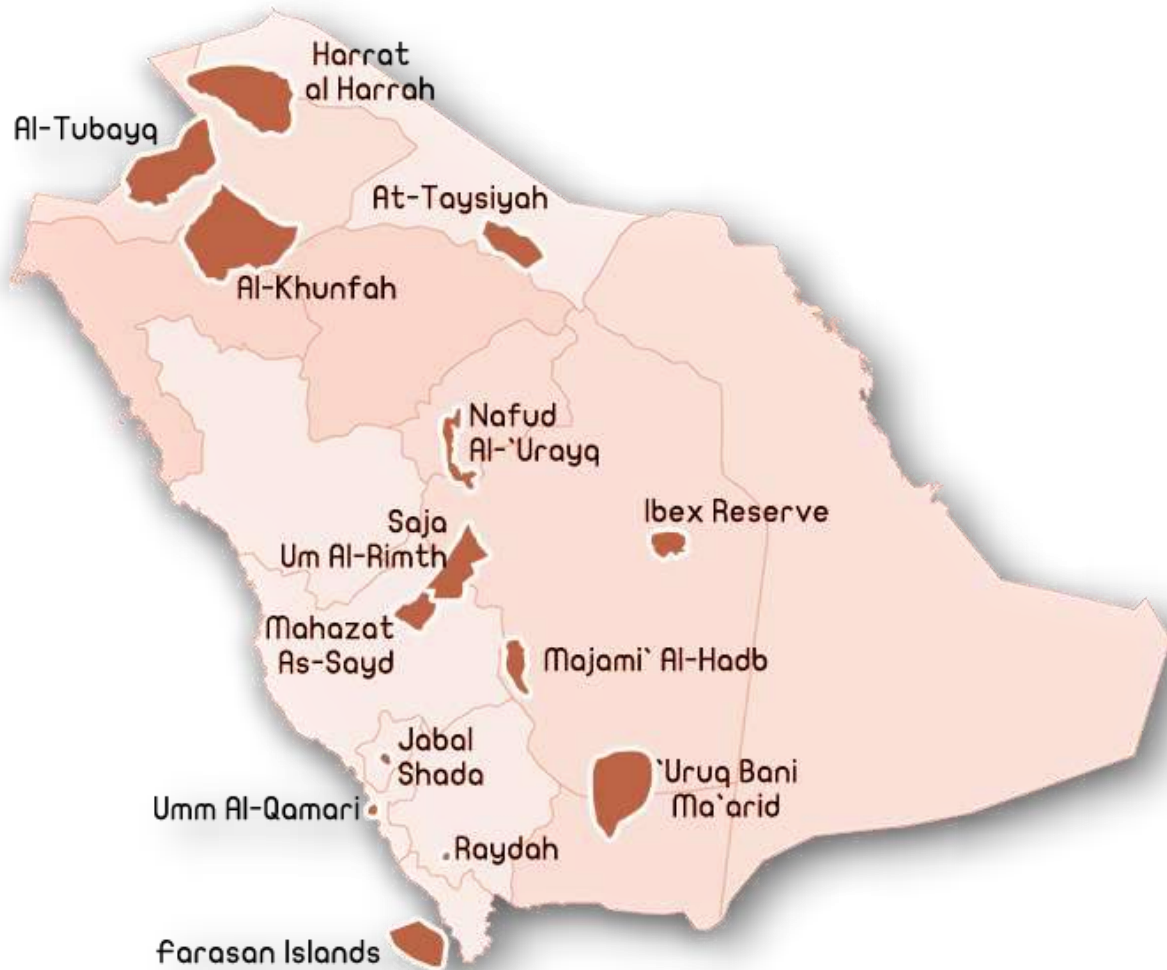


Figure: Protected areas within the Saudi Arabia



The currently existing protected areas include **15 protected areas (12 terrestrial protected areas and three marine protected areas)** with the aim of preserving a set of integrated natural ecosystems, which are: Jabal Shada, Majami al-Hadb, Jurf Raydah, 'Uruq Bani Ma'arid, Harrat al-Harrah, Al-Khunfah, Ibex Reserve, ...

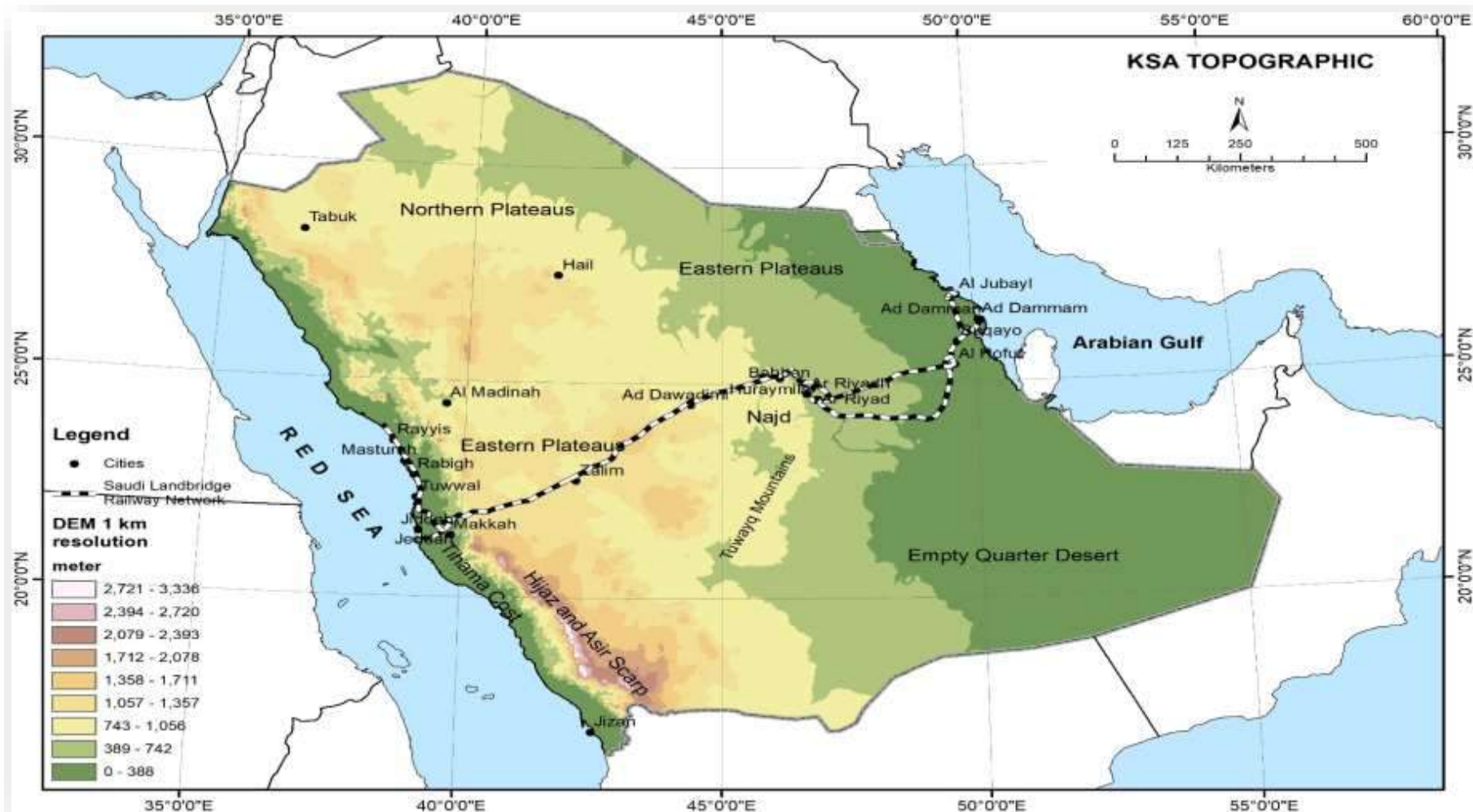


Figure: Elevations from the sea surface

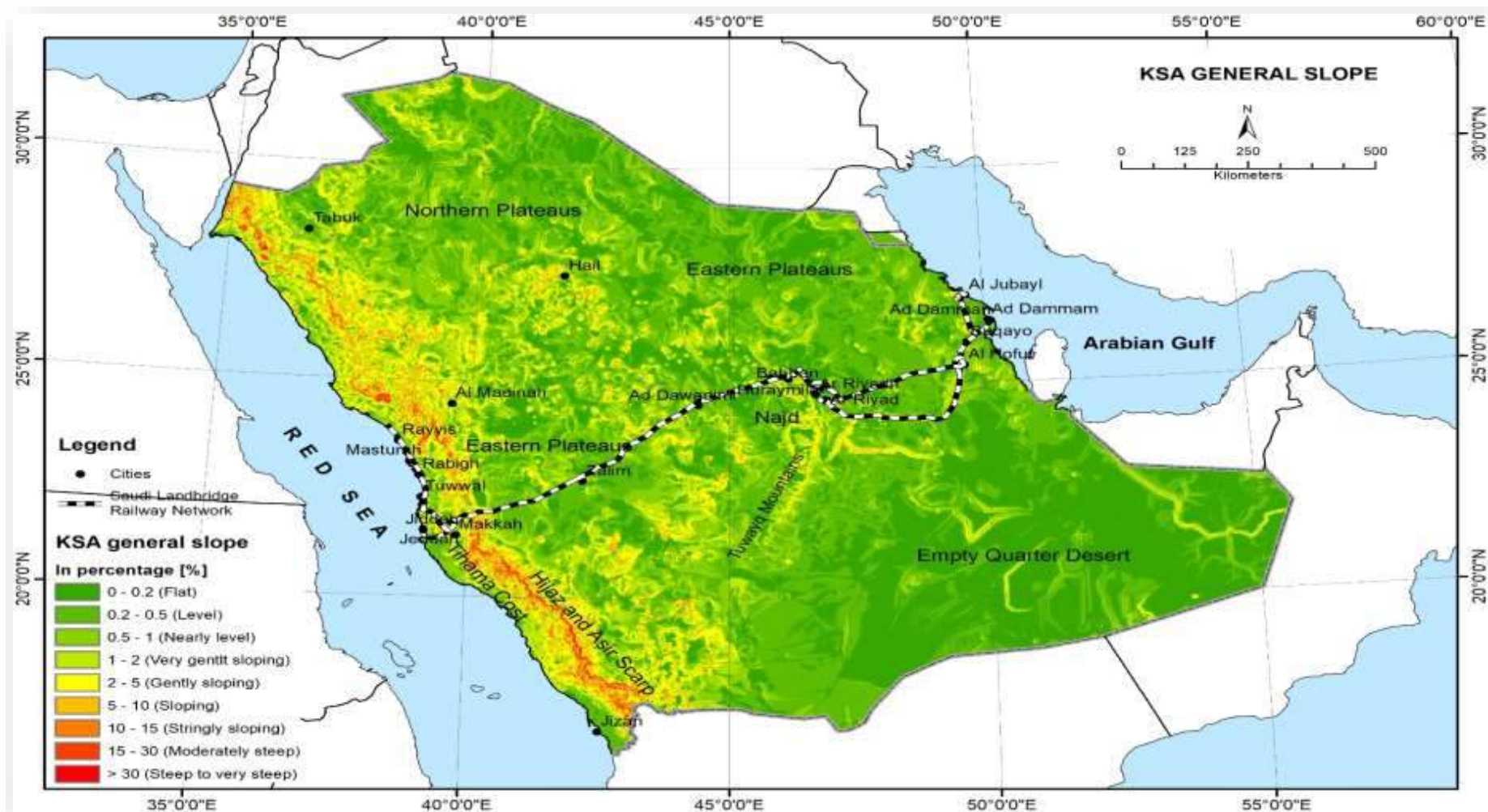


Figure: A map showing the general range of the degree of inclination in the Kingdom of Saudi Arabia



1. SOCIO-ECONOMIC INFORMATION FOR AR RASS SOLAR POWER PLANT SITE,

This part of the Socio-Economic Impact Assessment (SEIA) identifies the key socio-economic issues associated with the development of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass, during construction and operational phases. The significance of proposed development on the local economy and amenity issues is also assessed where necessary, potential mitigation measures have been suggested through this study.

Methodology

This Socio-Economic Impact Assessment (SEIA) is designed to assess the potential effect on the communities either positive or negative by the development of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass. Community is often the most highly valued aspect of socio-economic study. Community wellness is the term generally used to assess the social structures of a community. The state of community wellness depends on the wellbeing of all aspects of a community, individuals, families and the community as a whole. It may be significantly enhanced by project benefits and vulnerable to adverse effects. The community-driven approach is the most famous tool to assess the socio-economic aspect for any development project. This approach to assessing the effects of the project is community-focused, addressing community concerns. The aim is to design this study is to optimize the effects from Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass on residents as beneficial to their communities or the effects they believe are undesirable. In order to assess the potential social and economic impacts associated with the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass community-driven based assessment is undertaken comprising the following tasks:

- Review of indigenous communities' status located nearest to the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Project in relation to their role and rights;
- The identification of potential impact on the community social activities in relation to construction and operation of the AR-SIPVPP Project;
- An assessment of project skill requirements in relation local skill availability for the development;
- An assessment of potential social and economic impacts including the operation of the AR-SIPVPP Project, local services and resources in future;
- A qualitative assessment of potential health and safety issues associated with the operation and maintenances of AR-SIPVPP Project.



Purpose and Objectives

The purpose of this study is to represent the relevant and currently available information on the recent existing background and expected circumstances of the communities and people that might be affected by the operation of AR-SIPVPP Project. This section takes an issues-focused approach on baseline information. The focus is on community wellness, which is a deliberately broad term that includes the physical, emotional, social, cultural and economic well-being of a community, including individuals, families and the community as a whole. The objective is to identify the indicators of these various aspects of community, interrelationships between them and the influences acting on them, within the limited available data. The socio-economic study in this report is divided into two parts, first part describes the socio-economic baseline condition of the study area through the indicators are as follows:

- People and the economy;
- Infrastructure and community services;
- Individual, family and community wellness;
- Traditional culture;
- Non-traditional land and resource use;
- Heritage resources

The Socio-Economic Impact Assessment (SEIA) methodology and the possible effect from the construction and operational phases of the AR-SIPVPP Project are discussed in this study.

Legal Requirements

Saudi National Legislations

The Labour Law (Royal Decree No. M151, 2005) defines the regulation of employment, labor relations, worker contracts and work place conditions. This law contains provisions intended to protect the interests of both employers and employees with the aim of establishing a stable, equitable and sustainable work environment. This law will therefore provide a minimum legal basis for the engagement of the workforce for AR-SIPVPP Project. The working conditions and worker housing.

This law also specifically addresses such issues as protection against occupational hazards; major industrial accidents and work injuries, health and social services.

This law will apply to the construction and operational workforce as well as to both the project company staff and all contractors.

Equator Principle II 2020

Principle 1: Review and Categorization When a Project is proposed for financing, the EPFI will, as part of its internal environmental and social review and due diligence, categorize it based on



the magnitude of its potential environmental and social risks and impacts. Such screening is based on the environmental and social categorization process of the International Finance Corporation (IFC). Using categorization, the EPFI's environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts.

The categories are:

Category A – Projects with potential significant adverse environmental and social risks and/or impacts that is 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 measures; and

Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

Principle 2: Environmental and Social Assessment For all Category A and Category B Projects, the EPFI will require the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimize, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed AR-SIPVPP Project. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialized studies may also need to be undertaken. Furthermore, in limited high-risk circumstances, it may be appropriate for the client to complement its Assessment Documentation with specific human rights due diligence. For other Projects, a limited or focused environmental or social assessment (e.g. audit), or straight-forward application of environmental siting, pollution standards, design criteria, or construction standards may be carried out. For all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of CO₂ equivalent annually, an alternatives analysis will be conducted to evaluate less Greenhouse Gas (GHG) intensive alternatives. Refer to Annex A for alternatives analysis requirements.

Other principles are listed below:

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 Covenants

Principle 9: Independent Monitoring and Reporting

Principle 10: Reporting and Transparency

According to the classification above, the proposed AR-SIPVPP Project is a Category A project.

IFC Requirements

Applicable Requirements for Working Conditions and Management of Worker Relationship	
Performance Standard 1: Social and Environmental Assessment and Management Systems	
Performance Standard 2: Labor and Working Conditions	
Human Resources Policy	The client will adopt a human resources policy appropriate to its size and workforce that sets out its approach to managing employees consistent with the requirements of this Performance Standard.
Working Relationship	The client will document and communicate to all employees and workers directly contracted by the client their working conditions and terms of employment, including their entitlement to wages and any benefits.
Working Conditions and Terms of Employment	The client will provide reasonable working conditions and terms of employment that, at a minimum, comply with national law.
Workers' Organizations	The client will enable alternative means for workers to express their grievances and protect their rights regarding working conditions and terms of employment.
Non-Discrimination and Equal Opportunity	The client will not make employment decisions based on personal characteristics unrelated to inherent job requirements,
Grievance Mechanism	The client will provide a grievance mechanism for workers (and their organizations, where they exist) to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hire, and make it easily accessible to them.
Performance Standard 4: Community Health, Safety and Security;	
General Requirements	The client will evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the project and will establish preventive measures to address them in a manner commensurate with the identified risks and impacts.



Applicable Requirements for Working Conditions and Management of Worker Relationship

Infrastructure and Equipment Safety	The client will design, construct, and operate and decommission the structural elements or components of the project in accordance with good international industry practice
Hazardous Materials Safety	The client will prevent or minimize the potential for community exposure to hazardous materials that may be released by the project.
Environmental and Natural Resource Issues	The client will avoid or minimize the exacerbation of impacts caused by natural hazards, such as landslides or floods that could arise from land use changes due to project activities. The client will also avoid or minimize adverse impact due to project activities on soil, water, and other natural resources in use by the affected communities.
	The client will prevent or minimize the potential for community exposure to water- borne, water- based, water-related, vector- borne disease, and other communicable diseases that could result from project activities
Emergency Preparedness and Response	The client will assess the potential risks and impacts from project activities and inform affected communities of significant potential hazards in a culturally appropriate manner.
Security Personnel Requirements	When the client directly retains employees or contractors to provide security to safeguard its personnel and property, it will assess risks to those within and outside the project site posed by its security arrangements.

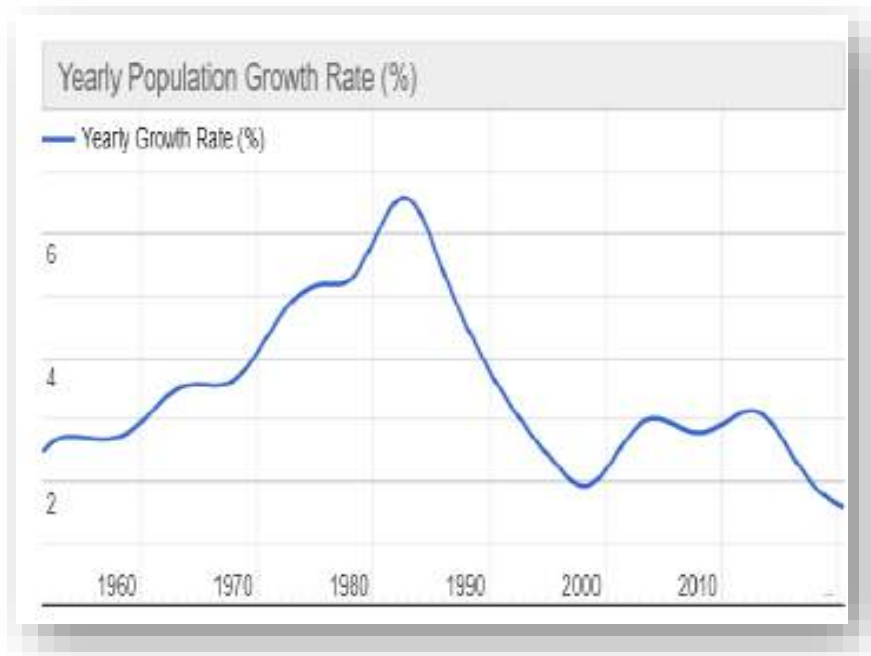
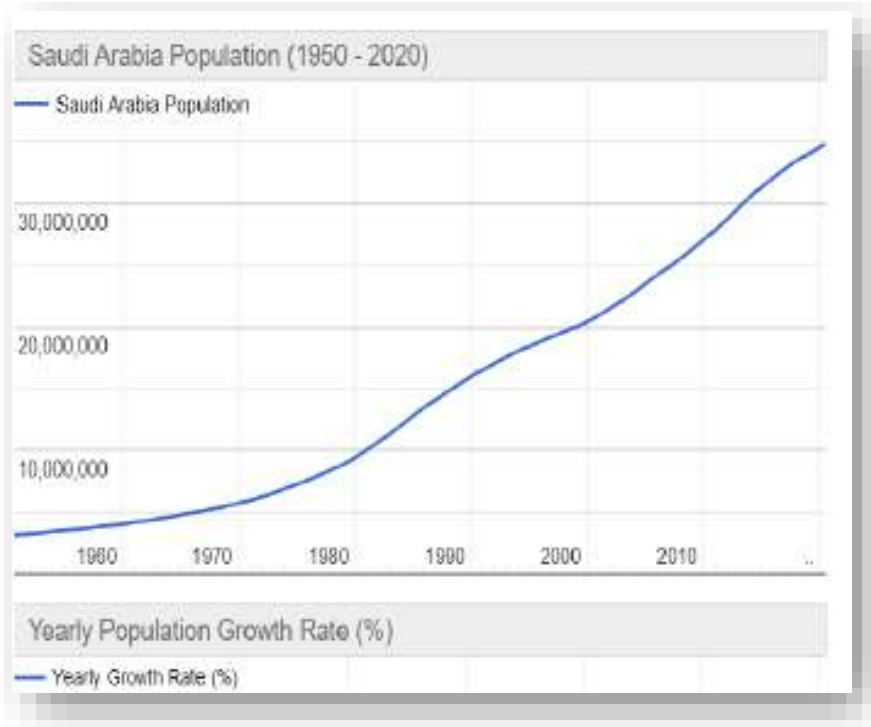
Performance Standard 5: Land Acquisition and Involuntary Resettlement

Performance Standard 7: Indigenous Peoples

- The current population of **Saudi Arabia** is 36,518,609 as of Monday 11th July 2023 10.30 PM, based on Worldometer elaboration of the latest United Nations data.
- Saudi Arabia 2020 population is estimated at **34,813,871** people at mid-year according to UN data.
- Saudi Arabia population is equivalent to **0.45%** of the total world population.
- Saudi Arabia ranks number **41** in the list of countries (and dependencies) by population.
- The population density in Saudi Arabia is 16 per Km² (42 people per mi²).
- The total **land** area is 2,149,690 Km² (830,000 sq. miles)
- **84.0 %** of the population is **urban** (29,255,576 people in 2020)
- The **median age** in Saudi Arabia is **31.8 years**.



Saudi Arabia Population (LIVE) : Monday 11th July 2023 10.30 PM





Population of Saudi Arabia (2022 and Historical)

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Saudi Arabia Global Rank
2023	36,947,025	1.48 %	538,205	28,998	30.6	2.36	17	83.5 %	30,846,442	0.46 %	8,045,311,447	40
2022	36,408,820	1.28 %	458,424	28,998	30.2	2.39	17	83.3 %	30,329,753	0.46 %	7,975,105,156	41
2020	35,997,107	0.47 %	169,745	-1,025,295	29.2	2.47	17	81.3 %	29,255,576	0.46 %	7,840,952,880	41
2015	32,749,848	2.17 %	667,584	60,337	28.3	2.64	15	80.2 %	26,249,243	0.44 %	7,426,597,537	41
2010	29,411,929	3.81 %	1,002,857	236,962	25.3	2.85	14	76.5 %	22,512,101	0.42 %	6,985,603,105	40
2005	24,397,644	2.52 %	570,051	481,349	23.2	3.24	11	79.3 %	19,358,664	0.37 %	6,558,176,119	46
2000	21,547,390	2.67 %	531,707	17,241	21.2	4.12	10	76.9 %	16,579,826	0.35 %	6,148,898,975	48
1995	18,888,857	3.37 %	576,819	27,095	19.3	4.95	9	78.0 %	14,739,559	0.33 %	5,743,219,454	48
1990	16,004,763	4.42 %	622,904	186,898	18.2	5.83	7	78.1 %	12,503,513	0.30 %	5,316,175,862	51
1985	12,890,245	4.85 %	543,707	163,926	17.0	6.70	6	74.3 %	9,581,553	0.27 %	4,861,730,613	53
1980	10,171,710	5.19 %	454,833	148,004	16.2	7.19	5	63.1 %	6,415,124	0.23 %	4,444,007,706	58
1975	7,897,544	5.28 %	358,271	132,741	16.6	7.37	4	54.9 %	4,334,558	0.19 %	4,069,437,231	65
1970	6,106,191	4.17 %	225,454	63,988	16.2	7.58	3	46.5 %	2,840,506	0.17 %	3,695,390,336	75
1965	4,978,922	3.63 %	162,672	28,951	16.1	7.66	2	37.7 %	1,877,805	0.15 %	3,337,111,983	83
1960	4,165,563	3.07 %	116,731	7,608	16.5	7.63	2	30.7 %	1,277,054	0.14 %	3,019,233,434	81
1955	3,581,910	3.00 %	98,443	2,108	17.3	7.59	2	25.8 %	923,917	0.13 %	2,746,072,141	83

Source: **Worldometer** (www.Worldometers.info)

Elaboration of data by United Nations, Department of Economic and Social Affairs, Population Division. [World Population Prospects: The 2022 Revision](#). (Medium-fertility variant).



Saudi Arabia Population Forecast

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Saudi Arabia Global Rank
2020	34,709,640	1.92 %	630,499	118,000	31.9	2.48	16	78.4 %	27,202,447	0.45 %	7,795,482,309	41
2025	37,290,305	1.44 %	516,133	60,000	33.2	2.29	17	78.0 %	29,085,517	0.46 %	8,185,613,757	42
2030	39,480,349	1.15 %	438,009	60,000	34.7	2.14	18	77.5 %	30,602,519	0.46 %	8,551,198,644	42
2035	41,317,419	0.91 %	367,414	60,000	36.0	2.02	19	77.4 %	31,999,465	0.46 %	8,892,701,940	42
2040	42,777,611	0.70 %	292,038	40,000	37.2	1.92	20	78.0 %	33,376,063	0.46 %	9,210,337,004	45
2045	44,026,516	0.58 %	249,781	40,000	38.5	1.84	20	78.8 %	34,697,663	0.46 %	9,504,209,572	46
2050	45,056,349	0.46 %	205,967	40,000	39.6	1.78	21	79.5 %	35,838,611	0.46 %	9,771,822,753	45

: **Worldometer** (www.worldometers.info/) , Department of Economic and Social Affairs, Population Division. [World Population Prospects: The 2020 Revision](#). (Medium-fertility variant).



Kingdom of Saudi Arabia
Ministry of Economy and Planning
Central Department of Statistics and Information



المملكة العربية السعودية
وزارة الاقتصاد والتخطيط
مصلحة الإحصاءات العامة والمعلومات

خرائط توزيعات النتائج الأولية
Distributions Maps of preliminary results
Population and Housing Census
2010
للتعداد العام للسكان والمساكن
١٤٣١هـ





Location:

The Kingdom of Saudi Arabia lies at the furthestmost part of southwestern Asia. It is bordered in the north by Kuwait, Iraq and Jordan, in the east by the Arabian Gulf, United Arab Emirates and Qatar, in the south by Yemen and Oman, and in the west by the Red Sea.

الموقع:

تقع المملكة العربية السعودية في أقصى الجنوب الغربي من قارة آسيا حيث يحدها شمالاً كل من الكويت والعراق والأردن ولبنان والخليج العربي والإمارات العربية المتحدة وقطر وجنوباً اليمن وسلطنة عمان وغرباً البحر الأحمر.

خريطة المملكة العربية السعودية Kingdom of Saudi Arabia Map

The Kingdom General Location

Kingdom Administrative Division

الموقع العام للمملكة

التقسيم الإداري للمملكة



Administrative Division

The Kingdom of Saudi Arabia is divided into 13 regions (amman). In addition to the headquarters of the region (amman), each region is divided into a number of governorates. The following table shows the regions (amman) of the Kingdom.

التقسيم الإداري

تقسم المملكة العربية السعودية إلى 13 منطقة إدارية (إمارة) وتقسّم المنطقة الإدارية إلى مراكز الإمارة، حيث تنقسم المنطقة الإدارية إلى مناطق. ويوضح الجدول التالي التقسيم الإداري للمملكة.

عدد المحافظات No. of Governorates	المنطقة الإدارية Region
19	الرياض Al-Riyadh
11	منطقة مكة المكرمة Makkah Al-Mokarramah
6	المنطقة الشرقية Al-Madinah Al-Shararah
18	القصيم Al-Qaseem
10	المنطقة الشرقية Eastern Region
11	البحر Bahr
8	تبوك Tabouk
3	حائل Hail
2	الحدود الشمالية Northern Borders
13	جدة Jeddah
7	نجران Najran
6	الباقة Al-Bah
2	الجوف Al-Jouf



Administrative Divisions of The Kingdom of Saudi Arabia (Governorates)

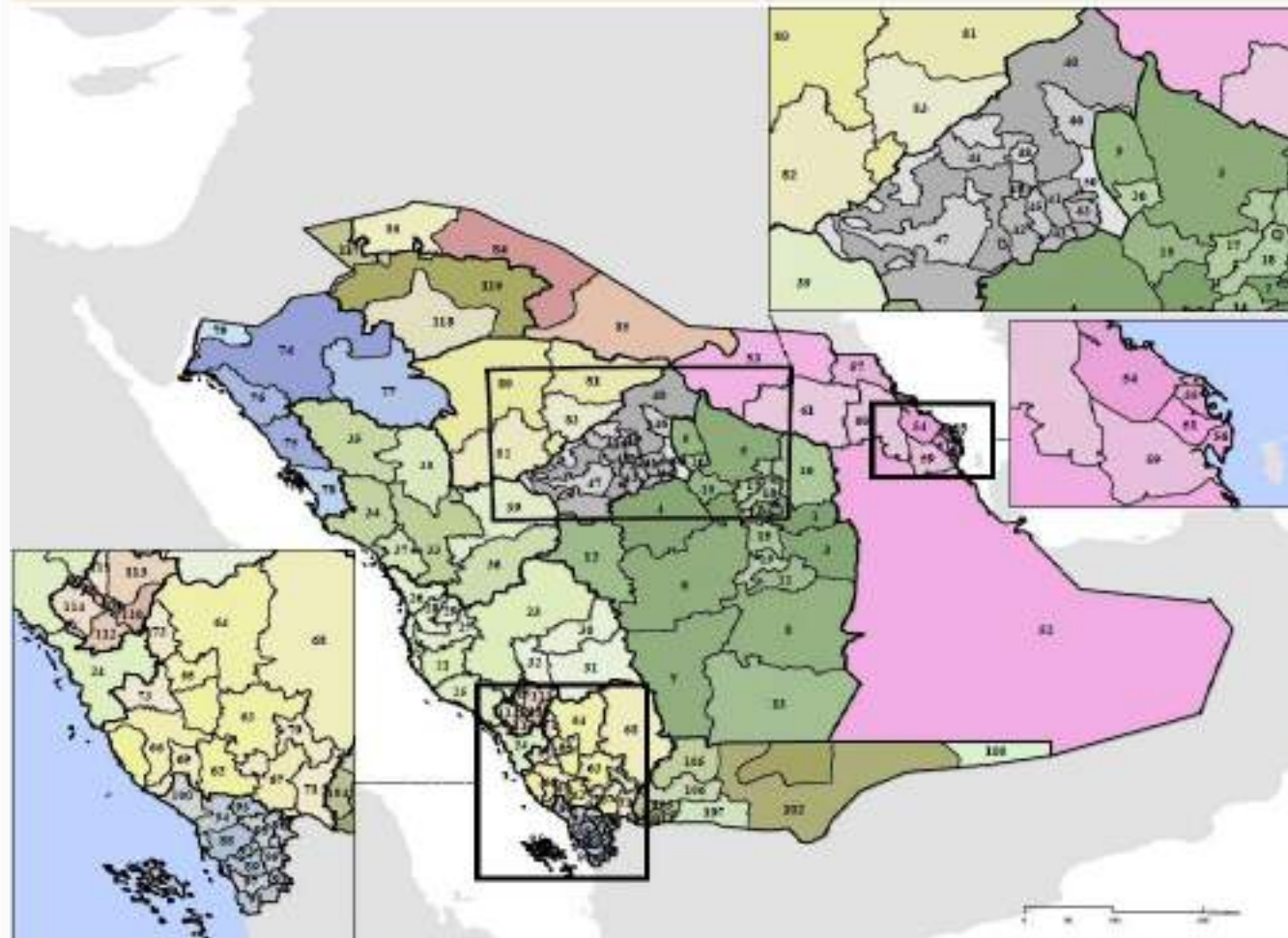
التقسيم الإداري للمملكة العربية السعودية (مخالفات)

Governorates

التقسيم الإداري
Administrative
Division

Governorates Index Code

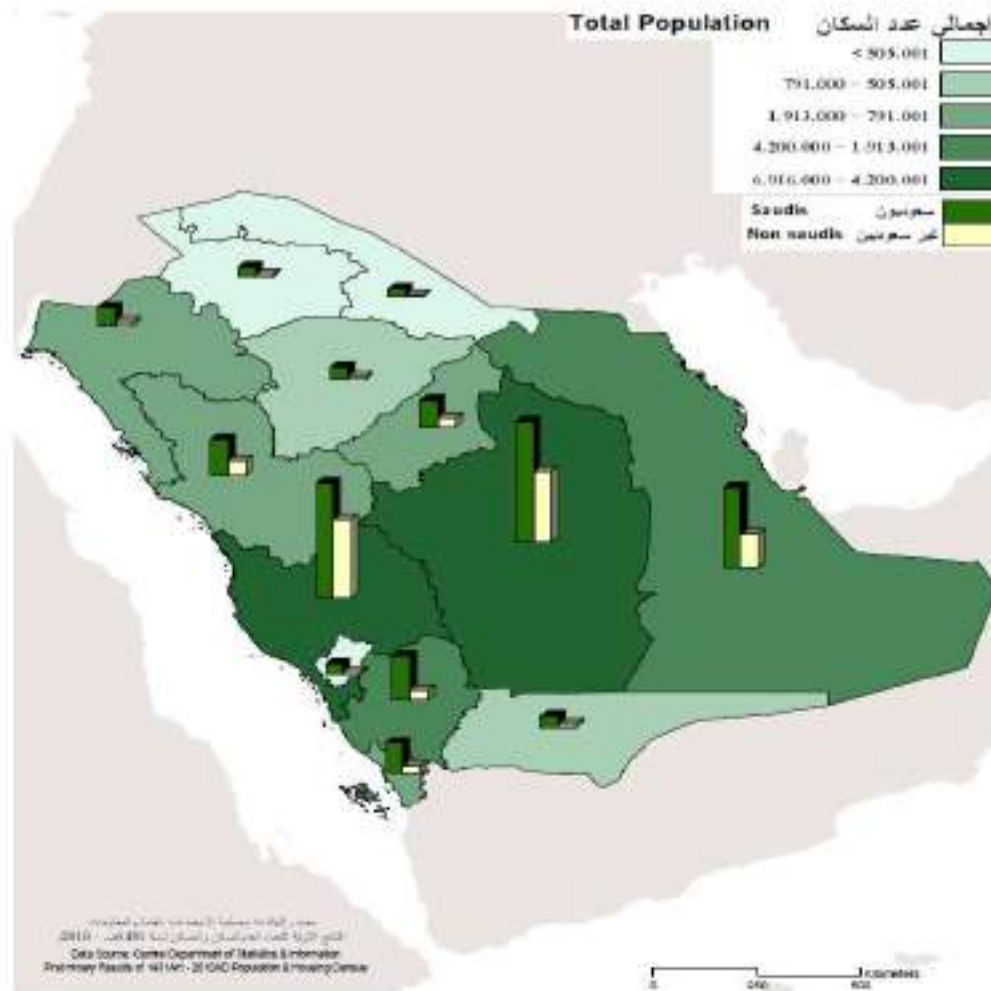
تابل رقم المخالفات



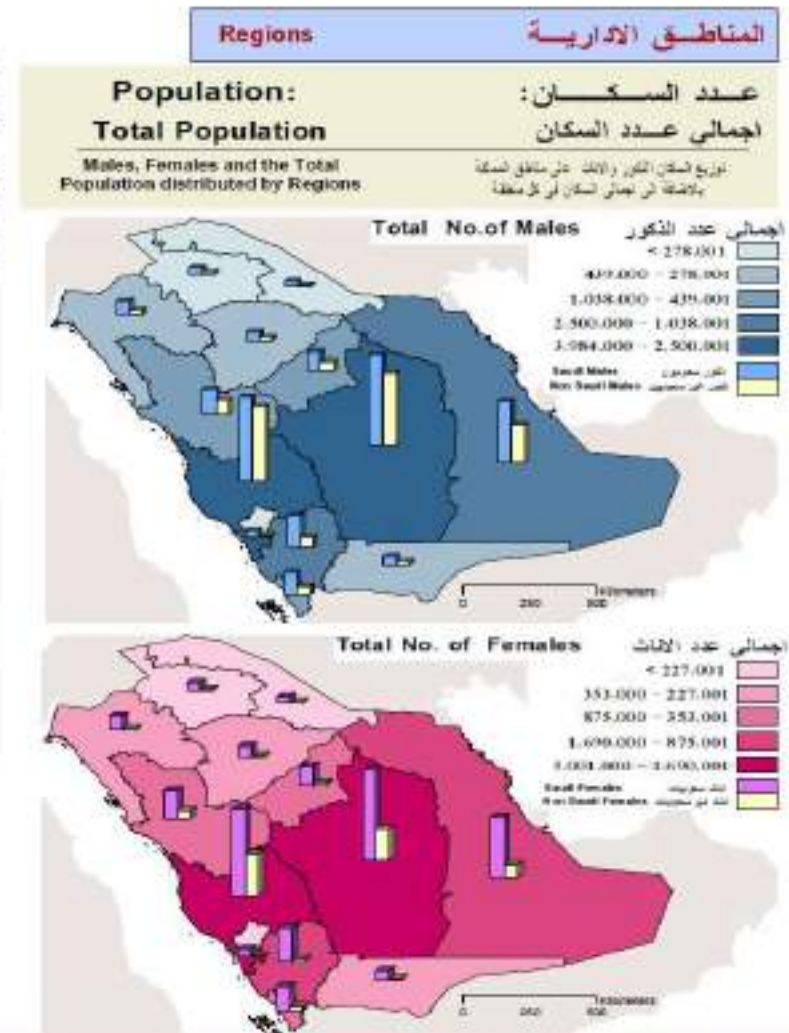
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Central Department of Statistics & Information

مصلحة الإحصاءات العامة والمعلومات



Central Department of Statistics & Information



مصلحة الإحصاءات العامة والمعلومات



Location:

Eastern Region is located in the west part of the Kingdom. It is bordered in the north by Kuwait, Iraq and the Northern Region, in the east by the Arabian Gulf, United Arab Emirates and Qatar, in the south by The Sultanate of Oman, and in the west by the regions of Ar-Riyadh, Al-Qassim, and Najran.

الموقع:

تقع المنطقة الشرقية في شرق المملكة العربية السعودية ويحدها شمالاً دولة الكويت وجمهورية العراق ومنطقة الحدود الشمالية وشرقاً الخليج العربي ودولة الإمارات العربية المتحدة ودولة قطر وسلطنة عمان وجنوباً سلطنة عمان وغرباً مناطق الرياض والقصيم ونجران.

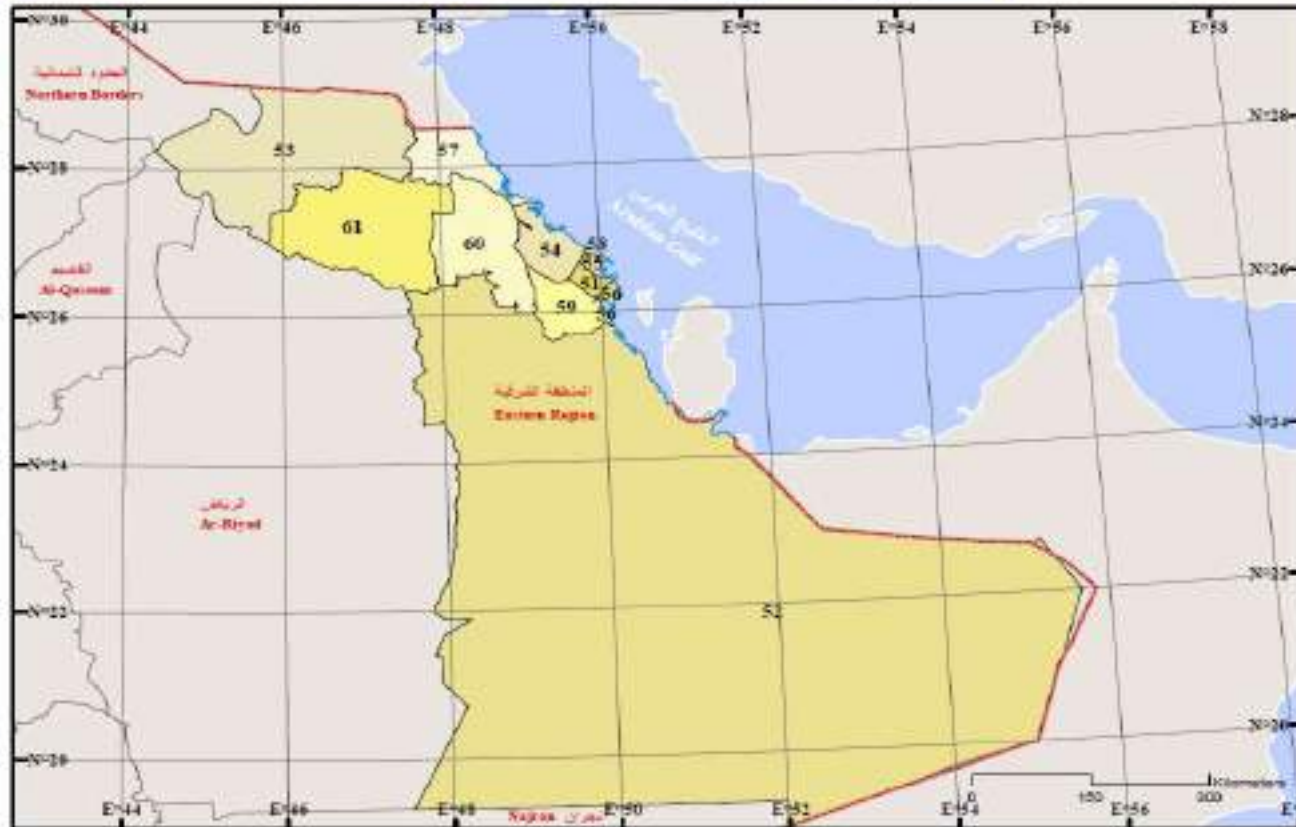
Eastern Region
General Location

المنطقة الشرقية
الموقع العام

Eastern Region Governorates

محافظات المنطقة الشرقية

منطقة الشرقية
Eastern Region



Governorates:
Eastern Region is divided into the emirate quarter and ten governorates. The following table shows Eastern Region's governorates:

المحافظات

تقسم المنطقة الشرقية إلى مقر الإمارة و عشر محافظات ويوضح الجدول التالي أسماء المحافظات:

Governorate	الرمز Code	المحافظة
Ad-Dammam	*51	الدمام
Al-Ahsa	52	الاحساء
Bahar Al-Batin	53	بحر الباطن
Al-Jubail	54	الجبيل
Al-Qatif	55	القطيف
Al-Khobar	56	الخبر
Al-Khafji	57	الخفجي
Ras Tanura	58	راس تنورة
Buqayq	59	بقيق
Al-Nayrivyah	60	النعيربة
Qatif Al-Ula	61	قربة العليا

* Emirate Quarter

* مقر الإمارة

تم إعداد الخريطة باستخدام برنامج ArcMap 10.2.1
الخريطة هي ملكية شركة كـوـا باور
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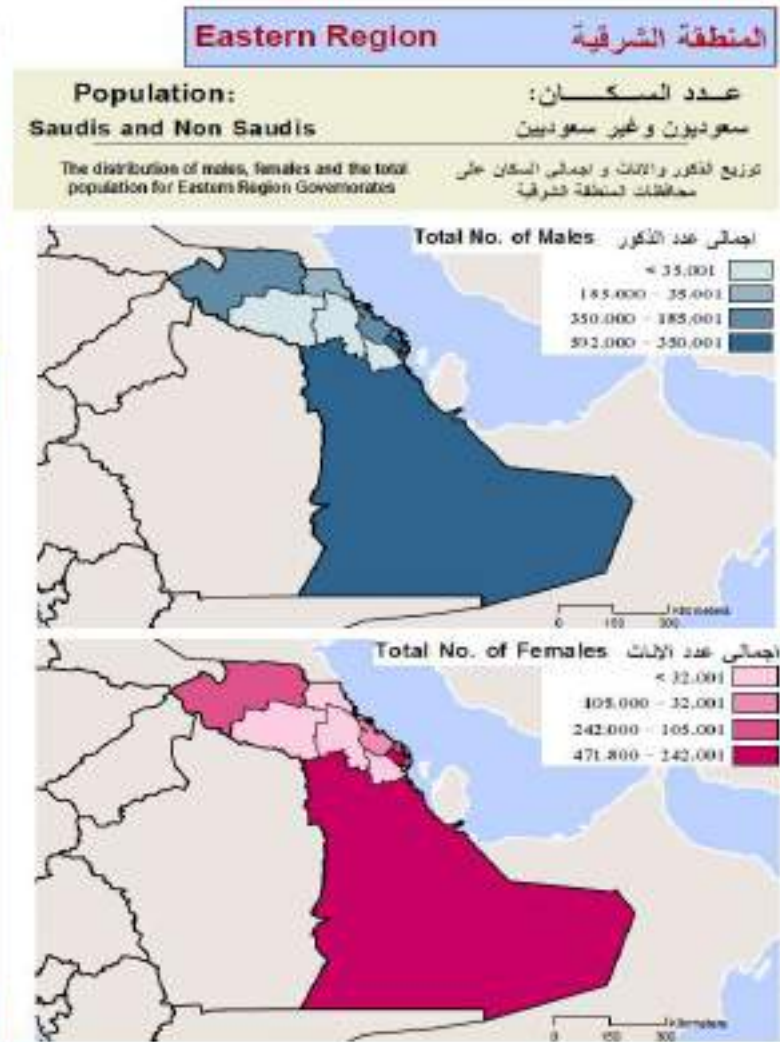
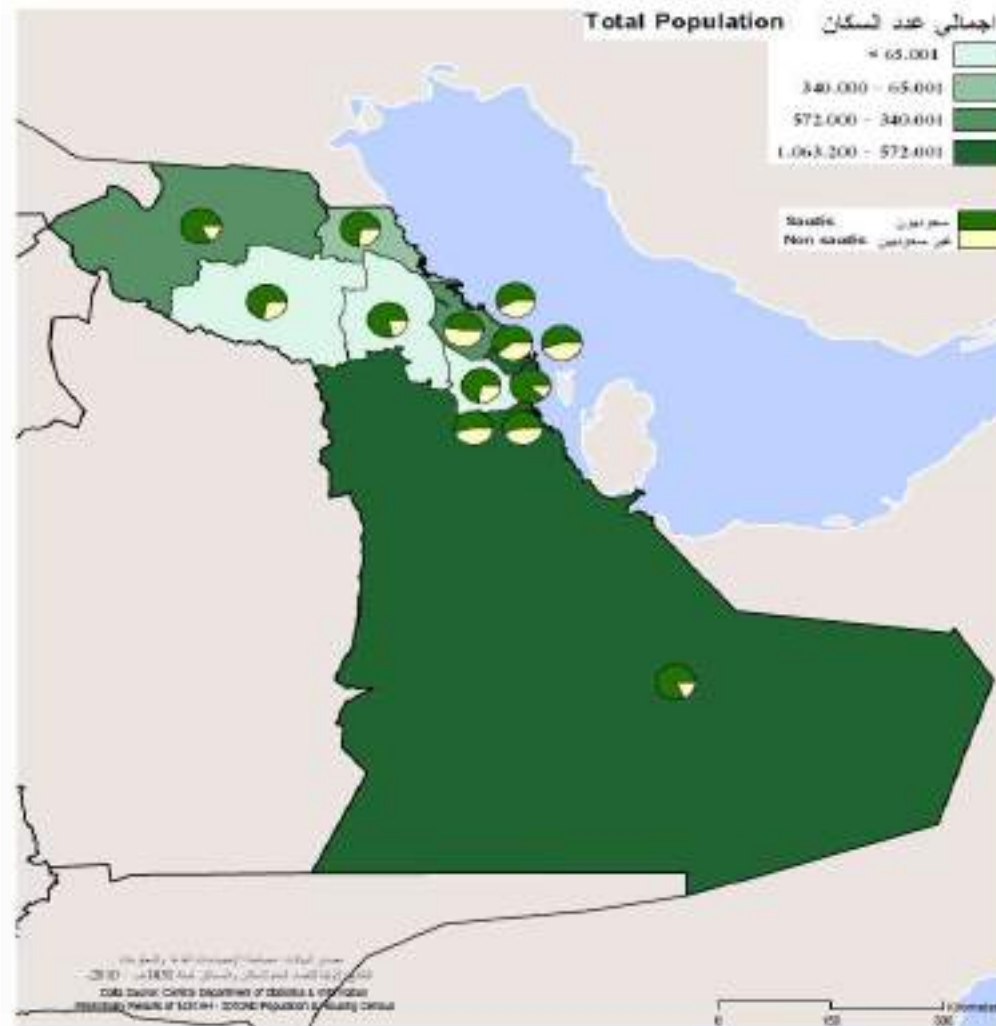




Table: Population by nationality and region, KSA,

Eastern	1,838,059	1,103,177	2,941,236

Table : Rate of MOH hospital beds per 10,000 population by region, KSA,

Eastern	2,941,236	3,056	10.4

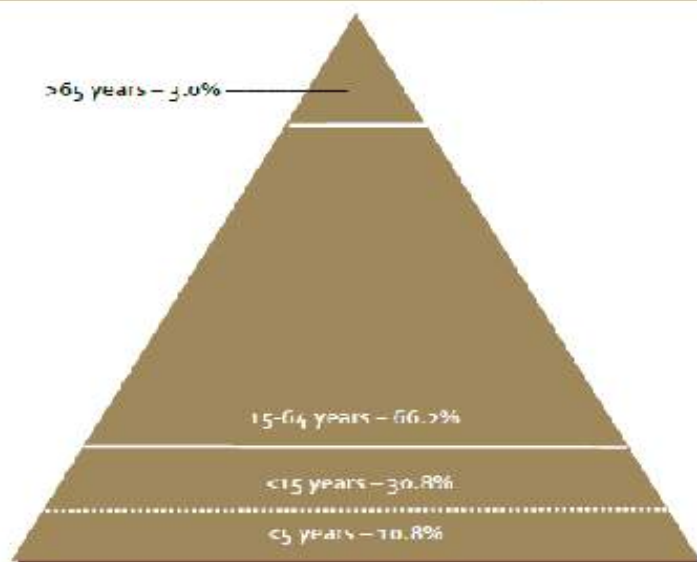


Figure 1.3: Population age-groups pyramid,

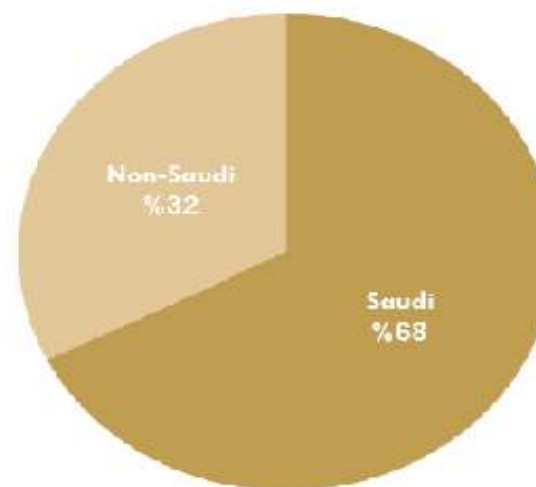


Figure 1.4: Population distribution by nationality,

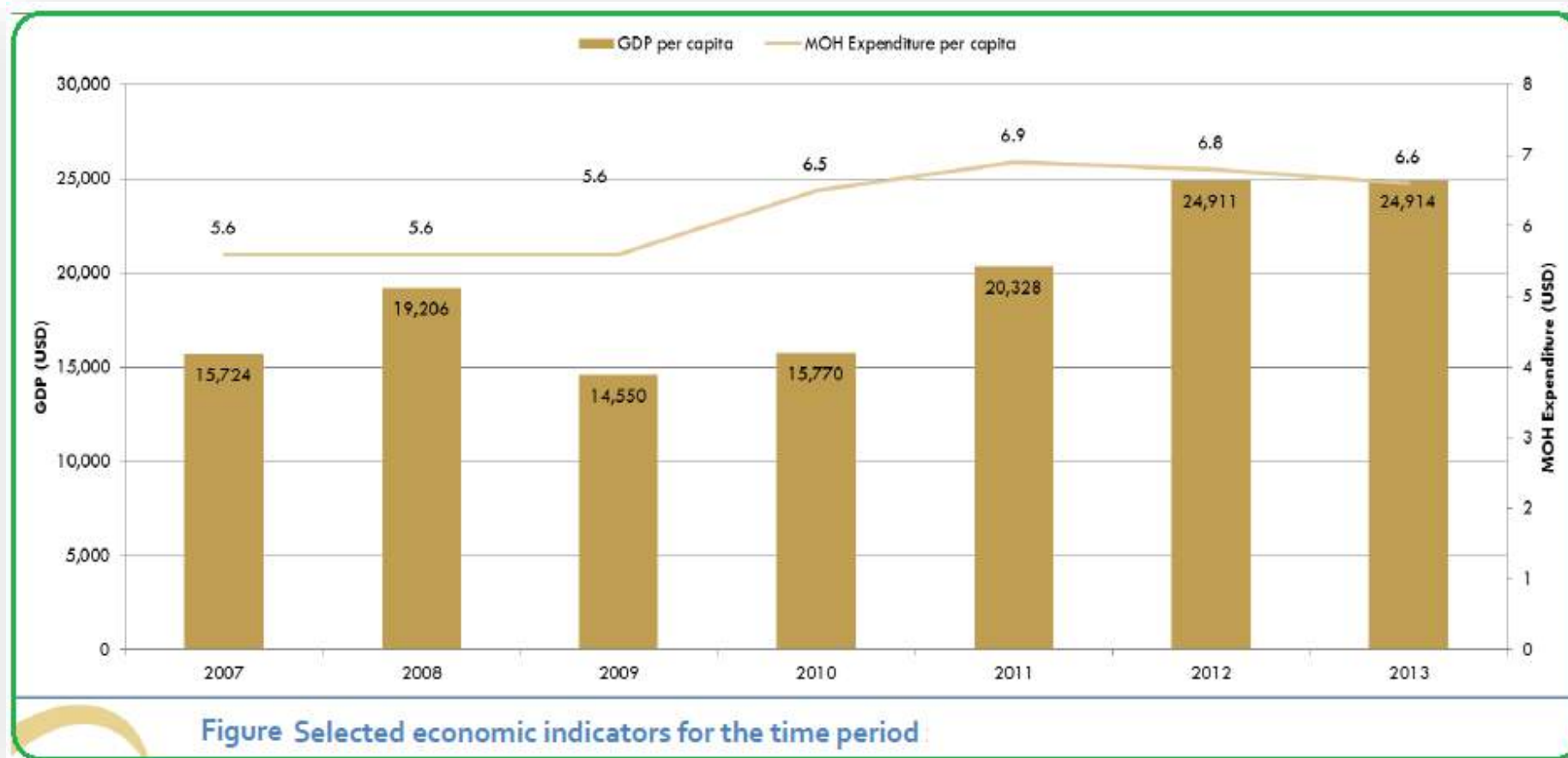




Table : Total MOH facilities by region,

Forensic Medicine	18
Anti-smoking clinics	236
Health centers control at entry points	1
Central laboratories	1
Rehabilitation centers	2
Dialysis Center	1
Diabetes Center	21
Dental centers	1
Oncology Center	1
Cardiology Center	1
PHC centers	4
Hospitals	3
Regions	1

Saudi Arabia Population by Year (Historical)

Year	Population	% Male	% Female	Density (km ²)	Population Rank	Growth Rate
2019	34,140,662	57.40%	42.60%	15.88	41	1.75%
2018	33,554,343	57.26%	42.74%	15.61	41	1.87%
2017	32,938,213	57.07%	42.93%	15.32	41	2.05%
2016	32,275,687	56.87%	43.13%	15.01	41	2.28%
2015	31,557,144	56.70%	43.30%	14.68	41	2.85%
2010	27,425,676	56.15%	43.85%	12.76	45	2.79%
2005	23,905,654	55.66%	44.34%	11.12	46	2.86%
2000	20,764,312	54.46%	45.54%	9.66	48	2.08%
1995	18,735,841	55.48%	44.52%	8.72	48	2.79%
1990	16,326,815	56.01%	43.99%	7.59	51	4.36%
1985	13,189,115	54.90%	45.10%	6.14	52	6.25%



Year	Population	% Male	% Female	Density (km ²)	Population Rank	Growth Rate
1980	9,740,599	53.64%	46.36%	4.53	61	5.57%
1975	7,428,703	52.02%	47.98%	3.46	72	4.94%
1970	5,836,389	50.91%	49.09%	2.71	76	3.80%
1965	4,843,635	50.46%	49.54%	2.25	78	3.46%
1960	4,086,539	50.22%	49.78%	1.90	83	2.81%
1955	3,558,155	50.44%	49.56%	1.66	84	2.65%
1950	3,121,335	50.75%	49.25%	1.45	85	0.00%
Year	Population	% Male	% Female	Density (km ²)	Population Rank	Growth Rate
2020	34,709,640	57.47%	42.53%	16.15	41	0.00%
2025	37,290,305	57.02%	42.98%	17.35	42	1.44%
2030	39,480,349	56.62%	43.38%	18.37	42	1.15%
2035	41,317,419	56.23%	43.77%	19.22	42	0.91%
2040	42,777,611	55.73%	44.27%	19.90	45	0.70%
2045	44,026,516	55.22%	44.78%	20.48	46	0.58%
2050	45,056,349	54.73%	45.27%	20.96	45	0.46%
2055	45,790,676	54.27%	45.73%	21.30	48	0.32%
2060	46,184,561	53.89%	46.11%	21.48	50	0.17%
2065	46,272,457	53.59%	46.41%	21.53	51	0.04%
2070	46,160,345	53.36%	46.64%	21.47	52	-0.05%
2075	45,951,118	53.18%	46.82%	21.38	52	-0.09%
2080	45,698,635	53.02%	46.98%	21.26	52	-0.11%
2085	45,406,141	52.85%	47.15%	21.12	53	-0.13%
2090	45,043,753	52.67%	47.33%	20.95	53	-0.16%
2095	44,589,081	52.48%	47.52%	20.74	53	-0.20%



Key Data

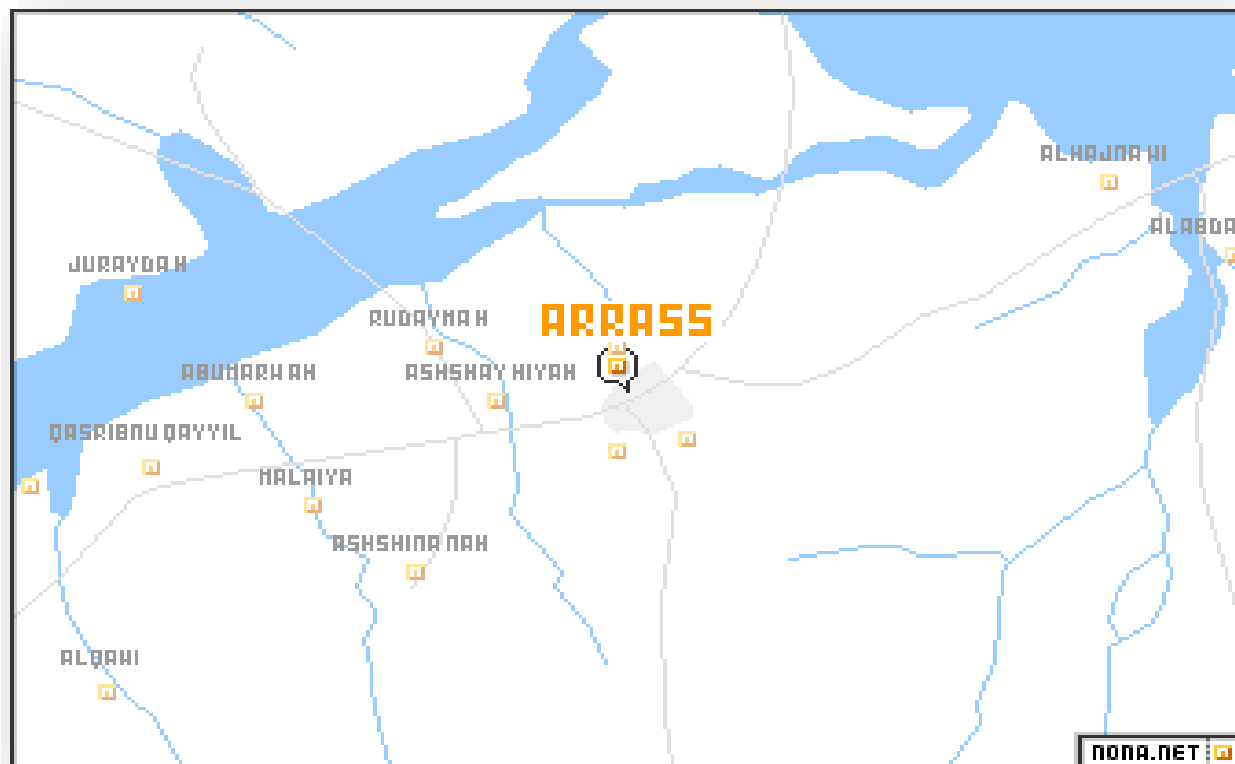
	2011	2012	2013	2014	2015	2016	2017E	2018F	2019F
Nominal GDP									
(SR billion)	2,517	2,760	2,800	2,836	2,454	2,419	2,564	2,817	3,052
(\$ billion)	671	736	747	756	654	645	684	751	814
(% change)	27.1	9.6	1.5	1.3	-13.5	-1.4	6.0	9.8	8.4
Real GDP (% change)									
Oil	12.2	5.1	-1.6	2.1	5.3	3.6	-3.0	1.5	3.3
Non-oil private sector	8.1	5.6	7.0	5.4	3.4	0.1	0.7	1.1	1.8
Non-oil government	8.4	5.3	5.1	3.7	2.7	0.6	1.7	2.2	1.7
Total	10.0	5.4	2.7	3.7	4.1	1.7	-0.7	1.5	2.4
Oil indicators (average)									
Brent (\$/b)	112	112	110	99	52	43	54	60	65
Saudi (\$/b)	104	106	104	96	49	41	51	58	61
Production (million b/d)	9.3	9.8	9.6	9.7	10.2	10.4	10.0	10.1	10.3
Budgetary indicators (SR billion)									
Government revenue	1,118	1,247	1,156	1,044	616	519	696	755	843
Government expenditure*	838	916	994	1,140	999	935	926	978	1,006
Budget balance	280	331	162	-96	-383	-416	-230	-223	-163
(% GDP)	11.1	12.0	5.8	-3.4	-15.6	-17.2	-9.0	-7.9	-5.3
Gross public debt	135	99	60	44	142	317	443	560	673
(% GDP)	5.4	3.6	2.1	1.6	5.8	13.1	17.3	19.9	22.0
Monetary indicators (average)									
Inflation (% change)	3.7	2.9	3.5	2.7	2.2	3.4	-0.3	5.2	0.2
SAMA base lending rate (% end year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	3.0
External trade indicators (\$ billion)									
Oil export revenues	318	337	322	285	153	137	159	180	199
Total export revenues	365	388	376	342	204	184	210	232	255
Imports	120	142	153	158	159	128	117	120	127
Trade balance	245	247	223	184	44	56	93	112	128
Current account balance	159	165	135	74	-57	-28	9	28	44
(% GDP)	23.6	22.4	18.1	9.8	-8.7	-4.3	1.2	3.8	5.5
Official reserve assets	544	657	726	732	616	534	496	474	458
Social and demographic indicators									
Population (million)	28.2	28.9	29.6	30.3	31.0	31.7	32.6	33.3	33.9
Saudi Unemployment (15+, %)	12.4	12.1	11.7	11.7	11.5	12.5	12.8	11.8	11.0
GDP per capita (\$)	23,827	25,471	25,223	24,962	21,095	20,318	20,968	22,585	24,027

Note*: 2016 Government expenditure includes SR105 billion in due payments for previous years

Sources: Jadwa Investment forecasts for 2018 to 2019. Saudi Arabian Monetary Agency for GDP, monetary and external trade indicators. Ministry of Finance for budgetary indicators. General Authority for Statistics and Jadwa Investment estimates for oil, social and demographic indicators.



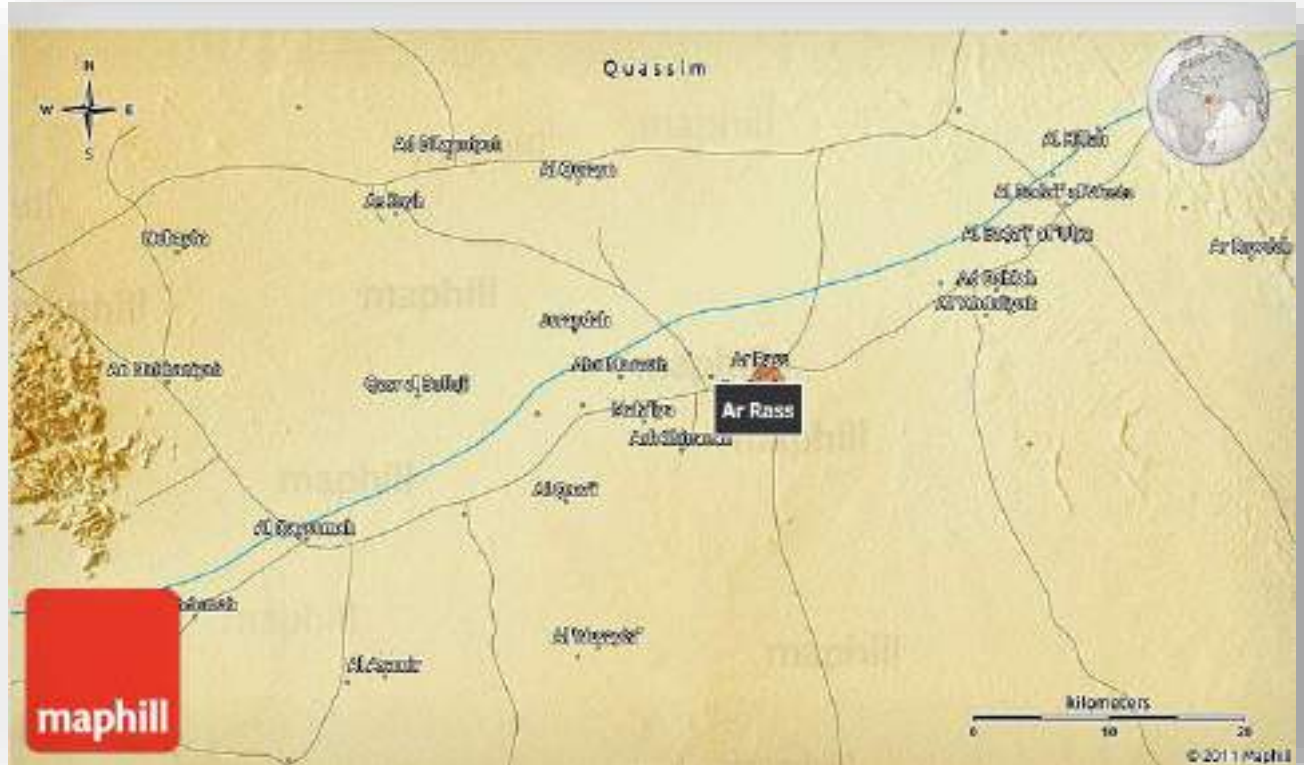
AR RASS: SOCIO-ECONOMIC INFORMATION





Ar Rass, Information

Ar Rass, Hail Province, Saudi Arabia on the map, where it is located. Latitude and longitude coordinates: 43.0243477, 27. 069917. It is a village in Easter Province of Saudi Arabia



Ha'il Province (Arabic: *مِنطَاقَة حَائِل* *Minṭaqat Ḥā'il*), also known as the **Ha'il Region**, is one of the 13 provinces of the Kingdom of Saudi Arabia. It is the eighth-largest province by area at 103,887 km² (40,111 sq mi) and the ninth-largest by population, with the population in 2019 being 731,147. The province accounts for roughly 2% of the population of the country and is named for its largest city, Ha'il. Other populous cities in the province include al-Ghazalah, Shinan and Baq'aa. The region is famous for the twin mountain ranges of 'Aja and Salma, and for being the homeland of historic symbol of curiosity and generosity, Hatim al-Ta'i.

The province is popular for hosting the geographically and historically important twin mountain ranges of 'Aja and Salma, which are now areas protected by the Saudi Wildlife Authority. In addition, multiple rock art sites can be found in the province, two sites of which have been added to the UNESCO World Cultural Heritage Site List; Jabal Umm Sinman near Jubbah and Jabal al-Manjur. Multiple old forts and castles can be found in the region, especially in and around the capital, Ha'il.



Another important site in the province are the sandstone formations, such as the Nafud al-Kabir formation.

The area is known to have been inhabited since at least the Paleolithic period, with several archaeological sites dating back to 10000 BC to 7500 BC. Several sites with archaeological rock art and other artifacts have been found in the province. The province is inhabited by members of the Shammar tribe, who ruled the area and other areas surrounding the province from 1791 to 1922 as the Emirate of Jabal Shammar; when King Abdulaziz conquered the region.

The province is divided into 8 governorates, and more than two-thirds of the population of the city lives in the capital city of Ha'il. The incumbent Provincial Governor is 'Abdulaziz ibn Sa'ad al-Sa'ud. It is bordered, clockwise from the north, by the Northern Borders Province, Eastern Province, Qassim Province, Madinah Province, Tabuk Province and Al Jawf Province.

Rass (also spelled **Ar Rass**, or **Al-Ras**; Arabic: الرس) is a Saudi Arabian City, located in Al Qassim Province. It lies southwest of Buraydah, the capital of the province and north of Riyadh, the national capital.

Ar rass is the largest city in Al-Qassim Province by area and third largest by population Rass is Arabic for "an old well", and it was mentioned in a poem of Hassan Bin Thabit, the poet who was a companion (Sahaba) of the Islamic prophet, Muhammad.^[citation needed]

The city is ruled by the Al Assaf family. It has 19 official sub-governorates, and is surrounded by around two hundred villages, and Bedouin settlements, mainly on its southern and western sides. and al-Rass is a historical city that was a resource for the Arab tribes in the peninsula, and most of Najd, especially Qassim, was inhabited by the tribes of Bani Asad, which were left to be replaced by other tribes. He was the first to inhabit the Al-Rass after the Asadites, the Banu Tamim, who moved to it from Ashikar, and the Banu Lam and their most tribes followed them, the Dhafir tribe and Al-Fadoul tribe, along with the Al Katheer and Al Mughayra family.

Ar Rass is the third largest city in Al Qassim Province by population, total population of 133,000 (2010 census). It is also thought to be the largest city in Al Qassim Province by area. It has an area of about 60 km².

Ar Rass in language

The old well, so if the word rass is used, it means the old well, and this town has a share of its name, as it was in the ancient time the source of the Arab tribes.



The Valley of Women is famous since the days of ignorances and is located in the southern part of Al-Rass, where there are trees. It is a very famous valley and frequented by many residents of Al-Rass governorate, especially in the spring.

Location

Ibn Manzur (Lisan al-Arab 6/98) says: (Al-Ras and Al-Risse are two valleys in Najd or two places, and it was said: They are two well-known waters in the Arab countries, and Al-Rass is the name of a valley in the words of Zuhair bin Abi Salma:

They gave birth to a firstborn, and took their souls with magicians ... for they and Wadi Al-Rass are like hands in the mouth And Yaqut al-Hamwi (Mu'jam al-Buldan 3/43) says al-Rass and al-Rassis ... and religions are in Najd or two places This was mentioned by Ibn Bleehed (Sahih al-Akhbar 4/226). And Al-Asma'i said: The Ras Lubna is faint of Rahat Hammam.

Ibn al-Saket says: Rass is a valley near Aqil, with palm trees in it. Perhaps he was talking about it in his time, as it was in Jahiliyyah. Al-Rass was water that was brought back by the donkeys of the beast and its cows, and from that it became clear that Al-Rass was an ancient city that during the era of the Jahiliyyah was a source of water for the tribes, then when Islam came, it entered construction like others, since Ibn al-Skeet lived in the third century AH, no doubt That he transmitted his words from others who presented him. As mentioned in the Saudi City Atlas, the total area of Al-Rass Governorate is estimated in hectares in 1407 AH (700050) hectares, equivalent to (70000,500) square kilometers. At the present time, and after the governorate expanded thanks to the urban renaissance and the large number of migrations coming from the neighboring villages and desertions, the length of the governorate reached about 12 kilometers by 10 kilometers (120 square kilometers).

Geography

Rass has a typical Nejd terrain, with sand dunes surrounding the town's sides, except for the western and southern sides, which are occupied by Bedouin settlements. The Wadi al-Rumma (Rumma Valley) crosses the city from its southern side to its north-eastern side. There are several medium-height plateaus, and low-height mountains surrounding the town, mainly on the southern side, which are called "Jebel Algoshie" by locals. There are several old ruins of a place by the name of "Shinanah". These were old fortifications used in battles between Al-Saud and Al-Rashid

Climate

The town of Rass has a typical desert climate, known for its cold winters and hot and aneroid summers, with low humidity. The average temperature during winter is between -3° and 21 °C. June,



July, August, and September are the hottest months. In summers the degree could reach extreme levels (between 39° and 50°).

Foundation

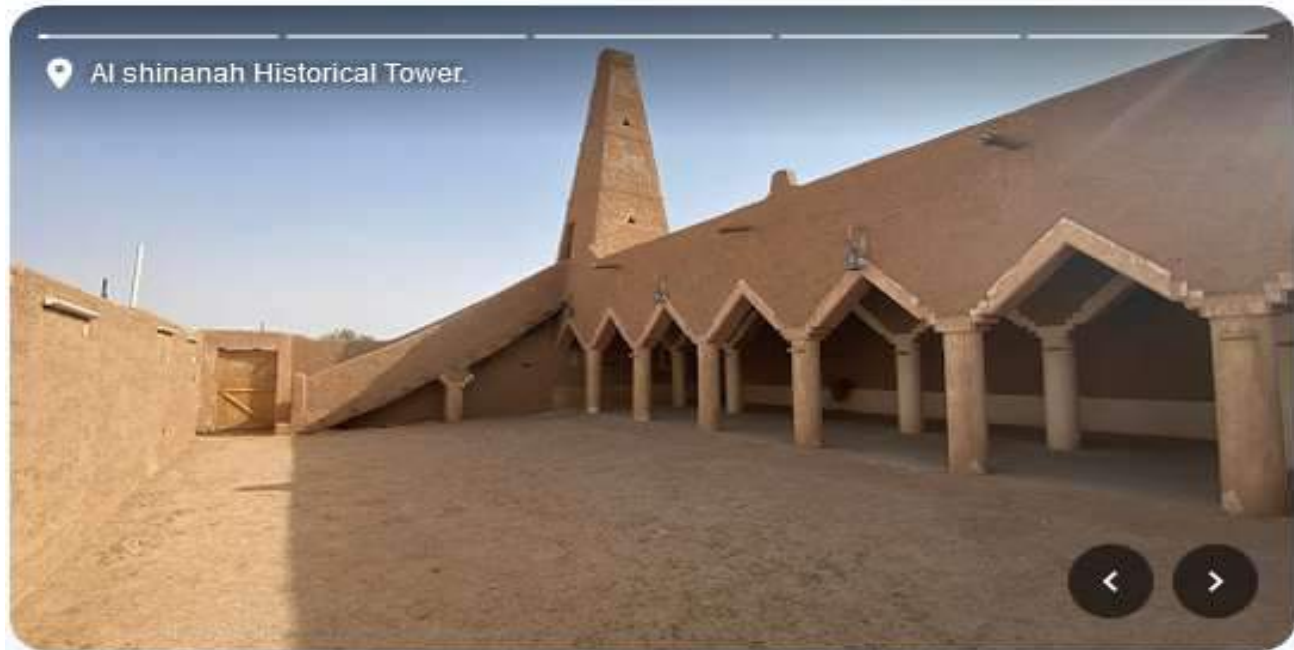
After the Arab tribes left Najd, among them the tribes of Bani Asad that inhabited the greater part of Qassim, other tribes took their place, and it was one of the Arab tribes that settled in Najd and the tribes of Bani Tamim or Hamidan were famous and those who moved from Ashikar to Al-Rass for work and trade as they served the province in the past And to our present time, as well as the Bani Lam, who have gained influence and dominance over most of the countries of Najd, and one of the most famous tribes of Bani Lam was the Zafir tribe. The people who lived in Alya, Najd and their outskirts, Al-Qassim, the tribes of curiosity, and the many families of Al Mughira. In the tenth century onwards, these valleys descended from Najd to Iraq and were replaced by the Anza tribes, which had their money from abundance and power and influence for a long time. And he builds some houses when he gets tired of the life of the desert, and another part works in agriculture and grows the land, and it happened between the Anza tribes and the Dafir tribes for a number of days and in the middle of the tenth century. From the migration, where the maid came to life again, after years and a long time. And groups of Arabs began to return to him with the intention of settling, as they established dwellings of mud in it, which soon formed a small village, and that was about the year 950 AH after they left the town of Ishaqir, one of the villages of al-Tashm, which was at that time one of the major lands of Najd, as was mentioned in the words of the Sheikh. Historian Ibrahim bin Saleh bin Isa, who said: (The well-known family of Saqiyyah left the country of Ashqir in the year approximately nine hundred and fifty and went to Al-Qassim, and they settled in Al-Rass, and it was in ruins without housing. They lived in it and extended it to agriculture ... etc.) and they built their homes, and their commercial contacts were in the town of Onaizah, which was in that era a source for spending their needs and household needs, which made them get acquainted with one of its settlers who used to do trade and he was called Abu Al-Hussain, whose name is Muhammad bin Ali from the Mahfouz family of Ajman Those who belong to Mukhir bin Yam from Hamadan al-Qahtani, and the friendship between him and the Saki family became stronger and they exchanged visits.

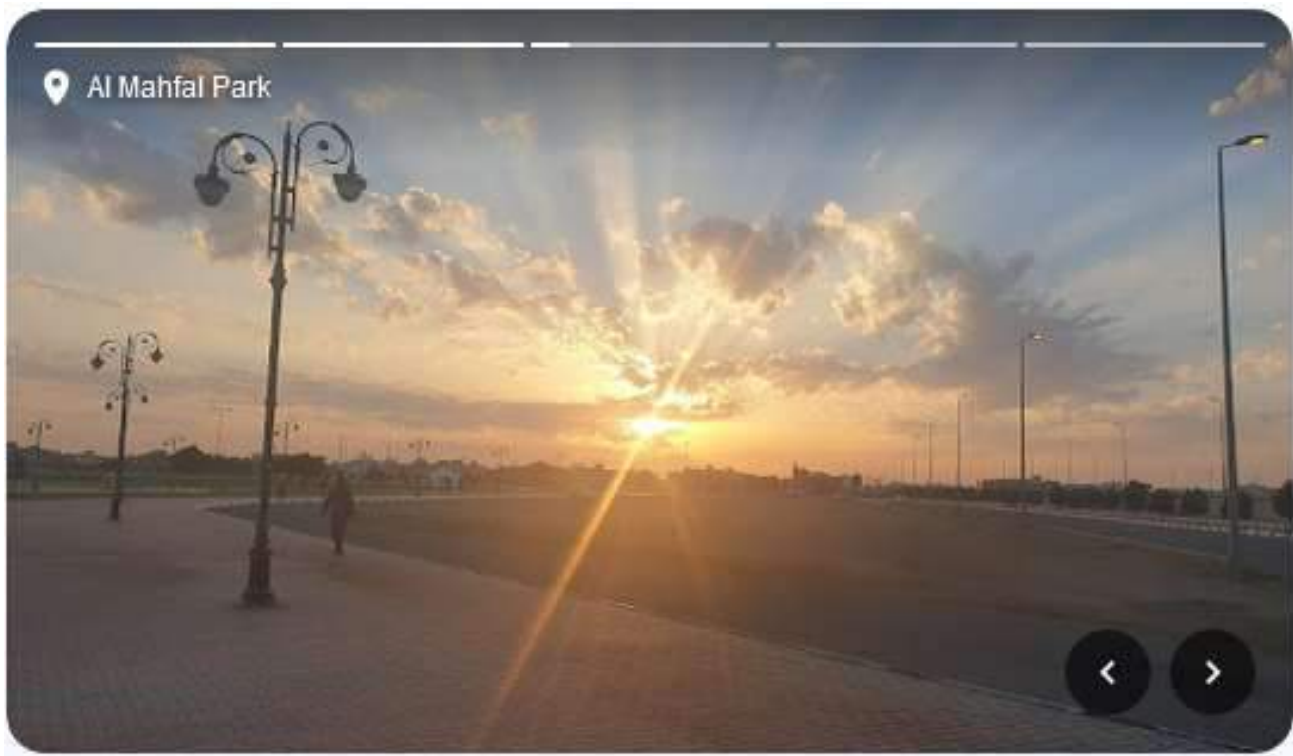
Villages belonging to Al-Rass

Al-Rass is followed by more than 200 villages. Al-Ras is the most governorate followed by the villages in the Qassim region, whether it is administrative, health, or service. Here is a list of some villages: 1. Abu Talah 2. Abu Nakhleh 3. Al-Ahmadiya 4. Al-Asamer 5. Al-Afihed 6. Al-Ba'a'a 7.



Badaa'i Al-Dabtan 8. Badaa Rayman 9. Badraa 10. Al-Badi'a 11. Al-Busairi 12. Baqi'a Al-Janoubia 13. Jabirah Al-Tawal 14. Al-Jurthi 15. Al-Jarzawiyah 16. Jufrah 17. Halisa 18. Halewa 19. Hamada 20. Al-Hamada 21. Al-Haniniyyah 22. Al-Khashibi 24. Al-Khatim 25. Al-Khanqa 26. Al-Dath 27. Al-Dara 28. Dahla









SOCIO-ECONOMIC FIELD SURVEY

A field campaign was conducted on April 2023 to identify the main communities and activities in the area of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project.

The socio-economic data was collected using household survey questionnaire, profiling guide, focus group discussion specific to issues (e.g. resource use and flow), and data at enterprise level. Information was captured on demographic profile, education, profession, health and sanitation, etc. The collected data was compiled from different studies. The study encompasses lots of information on different issues, not in depth, just an overview that may help the reader to have an idea about the AR-SIPVPP Project.

Socio Economic Effects Assessment

In order to assess the potential social and economic impact due to the construction and operational phases of AR-SIPVPP Project, the following monitoring and survey activities are conducted during the study period.

Assessment of Project Skill Requirements In Relation To Local Skill Availability

AR-SIPVPP Project will generate employment opportunities that will influence territorial and local labour market. To fulfill the possible demands of labour and suppliers the surrounding territorial area will respond. From socio-economic point of view this is a positive improvement of social as well as labour market.

Employment and Regional Economic Effects

AR-SIPVPP Project will generate a number of jobs scopes as well as the economic activities that will increase people's procurement power. The local and regional demand and supply will get forces. The employment opportunities from the AR-SIPVPP Project will influence territorial and local labour market. To fulfill the possible demands of labour and suppliers of goods and services the surrounding territorial area will respond. Due to water supply expansion, new settlement and industries in the region will increase gradually. The positive social and economic impact is expected from the AR-SIPVPP Project establishment.

Demography

AR-SIPVPP Project will generate attractive economic benefits that will affect community populations. It is expected that existing birth and death rates will be improved due to improvement of infrastructures and healthcare provider. All aspects of the project will create demands for labour



and local business opportunities, and thus tend to encourage migration to regional and other centers of business activity.

Residential

Project effects on housing and accommodation will include direct and indirect demands for short- and long-term accommodation. There is no short-term accommodation effect because the project is providing housing for its employees. However, effects on housing are expected to be adverse in the Ar Rass area because of less housing is available there. Table below shows expected housing effects. These effects are expected to be low magnitude, because it is expected that the local housing business sectors will generate sufficient quantity of housing facilities.

Table: Housing Effect Attributes for AR-SIPVPP Project

Location	Expected Effect Attribute				Significant
	Direction	Magnitude	Geographic Extent	Duration	
Construction area	Adverse	Low	Local	Short term	No

Summary

A summary of the key impacts, associated with social and economy for the AR-SIPVPP Project are provided in below. The potential overall impact includes impacts that would arise in the construction phase and in the operational phase of the AR-SIPVPP Project.

Potential Impact	Nature of Impact (Permanent or Temporary) (Direct or Indirect)	Significance (Major, Moderate or Minor) (Positive or Negative)	Mitigation / Enhancement Measures
During the construction and operational phase of the AR-SIPVPP Project is likely to benefit the local economy in terms of the provision of water supply to the Ar Rass area	Permanent	Major Positive	• No Mitigation Measures Required
The potential impacts from the presence of worker, like housing pressure on local area, and resources.	Temporary	Minor Negative	• The assessment has identified the lack of local provisions, in the form of housing, school facilities, because work force which are likely to have families. • It is expected the housing provision for the area will be solved by local business immediately.



The potential impact of the AR-SIPVPP Project operations on social health and safety	Temporary	Minor Negative	the implementation of appropriate measures as part of the Health, Safety and Environment Management Plan during the operational phase of the plant will ensure that occupational health and safety risks are minimised
Noise	Temporary, Direct	Minor Negative	Application of best practicable means

Cultural and Historical Values

There are no known cultural or historical values associated within the AR-SIPVPP Project site and it is not expected that any such values would be found. As there are not expected to be any features of archaeological or cultural heritage on or near the AR-SIPVPP Project site, no impacts are expected from the construction of the AR-SIPVPP Project. There several Historical sites in the vicinity of Ar Rass city are recorded. But these sites are located far away from AR-SIPVPP. Hence no mitigation are required.



SECTION 5.0 ESIA METHODOLOGY



SECTION 5.0 ESIA METHODOLOGY

5.1 Introduction

The ESIA is a systematic approach to identifying the potential impacts of a project and describing the mitigation, management and monitoring measures that will be implemented to address these impacts. Ultimately, the results of the ESIA will allow relevant organizations to make informed decisions about development proposals and allow potentially affected stakeholders to participate in the process. To ensure a robust and detailed impact assessment, the ESIA process has been structured over a series of progressive and iterative stages. Stakeholders, the Project Team, and the assessment team provide input to these stages during the ESIA process.

Deciding whether impacts are within or outside the scope of the ESIA is an important step towards ensuring that the impact assessment is relevant and properly tailored to the Project. Site specific environmental and socio-economic factors influence the nature and scope of potential impacts and can vary substantially between projects, even when developments appear similar. This chapter provides a general overview of the ESIA methodology to be applied, however, each discipline chapter will provide discipline-specific methodology, if applicable. The impact assessment process is summarized in Figure 5-1.

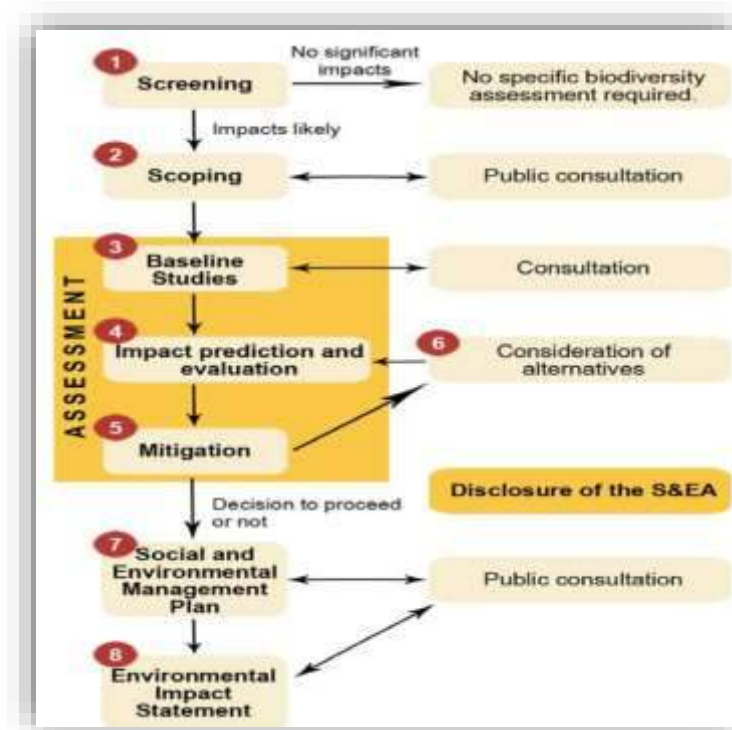


Figure 5-1 Simplified Impact Assessment Process



5.1.1 The Mitigation Hierarchy

The ESIA approach for the AR-SIPVPP project is based on the international environmental best practice known as the ‘mitigation hierarchy’. Figure 5-2 illustrates the mitigation hierarchy as it applies to impacts to biodiversity but would similarly apply to all potential Environment and Social impacts. The principle of the mitigation hierarchy is embedded in the IFC Performance Standards for ESIA. These are industry standards developed on behalf of the World Bank. Whilst they predominantly support the responsible development and decision-making in the financial sector, they provide a clear definition of a client’s responsibilities for managing their environmental and social risks and are widely considered best practice standards for any ESIA. The mitigation hierarchy strategy focusses first on avoiding impacts through design and then minimizing, mitigating, compensating and offsetting them. This process has started at an early stage for the AR-SIPVPP project (master planning phase), where potential conflicts between land use plans/infrastructure strategies and environmental assets were identified, and solutions to avoid and minimize these were proposed. In line with best practice, only once all efforts have been made to avoid and minimize impacts through design, the process of compensating for and offsetting residual impacts takes place.



Figure 5-2- The Mitigation Hierarchy

In addition to the IFC standards, the mitigation hierarchy has been implemented while respecting and considering relevant national legal and regulatory requirements, as well as, international agreements covered in Section 2.

5.1.2 Key Stages of the ESIA Process



The steps identified in Figure 5-1 are much simplified but convey the general approach to an ESIA. Potential impacts during the Construction and Operational phases of the Project are considered separately in the ESIA. A summary of the key stages of the ESIA process is provided below:

Screening: An early exercise to identify how the Project might interact with the environment. Screening focuses the ESIA on the most likely interactions and receptors and assists in incorporating environmental, social and cultural heritage considerations into project planning and design. Screening identifies the type of assessment required as well as the applicable legal framework governing the project activities.

Baseline Studies: A process to understand the existing environment through desk-based and field-based research so that impacts can be more accurately predicted, and to provide a baseline against which changes can be measured. It is important to note that baseline studies continue during the Scoping phase and into the ESIA phase. Field Survey Plans will be prepared prior to all surveys undertaken.

Scoping: Utilizes more detailed engineering data along with some preliminary baseline data and feedback from stakeholders. Scoping asks: what adverse impacts might occur? What benefits might the project have? How significant might these impacts be? What can be done to mitigate them? The Scoping phase also identifies the topics and methodologies which will be included within the main ESIA Report. The output of this phase is the ESIA Scoping Report.

Impact Assessment and Preparation of an ESIA Report: Predicts and assesses the expected impacts of the Project, based on the Project description, baseline studies, feedback from stakeholder, and professional expertise. The impact assessment categorizes potential impacts based on their significance, which may be rated as either Not Significant, or of Low, Moderate or High significance. This also includes the development of mitigation and management measures and the re-evaluation of the impacts after measures are applied (i.e. residual impacts). The output of this phase is the this ESIA Report and includes a framework for the Construction and Operation Environmental and Social Management Plan (ESMP) section 17 of this report

- **Avoid:** Assessment of alternative locations and layouts to reduce the direct impact of the project's footprint on sensitive habitats and other sensitive receptors.
- **Minimize:** Placement of essential infrastructure where its impact to sensitive habitats and other sensitive receptors is reduced to the smallest possible.
- **Mitigate:** Use of best practice design, construction and operational processes.



- **Compensate / Offset:** Identify areas that can be set aside as Protected Areas, restore degraded areas, or compensate for losses, displacement. Mitigation, Management and Monitoring: Commitments relating to the proposed mitigation measures in order to avoid, reduce, or offset adverse impacts, and enhance beneficial measures, will be contained in the framework ESMP section of the ESIA. The ESMP published with the ESIA will provide high level mitigation and monitoring measures and form the basis for the preparation of detailed management and implementation plans covering certain activities of the construction and operation phases for potentially affected receptors. It is important to understand that the ESIA process is not just a way to minimize impacts, but also a tool for decision-making. In reality, it is rarely possible to avoid or reduce all adverse impacts of a project. In the end, the ESIA process should clearly highlight what residual impacts of the project will be beneficial and adverse so that decision makers can make an informed judgment about the future of the Project.

5.2 Methodology

The proposed ESIA methodology used for this assessment is based on the KSA laws with additional consideration to IFC Performance Standards on Environmental and Social Sustainability, **Performance Standard 1:** Assessment and Management of Environmental and Social Risks and Impacts (IFC, 2012). The impact assessment methodology takes into consideration an impact's nature (adverse or beneficial), type (direct, secondary or cumulative) and magnitude, and the sensitivity of the affected receptors, to yield a prediction of the impact's overall 'significance'. Professional judgment and experience, data, models, and regulatory and industry standards can all contribute to the assessment of impacts, which ranges from technical analysis using quantitative criteria (such as quality standards for water or air) to more subjective measures, such as loss of visual amenity. Most impact assessments combine both quantitative and qualitative analysis. However, the criteria to be used to evaluate impacts are clearly defined hereunder.

It should be noted that impact significance is assessed taking into account existing control measures that are incorporated into the project design such as the use of bunding for fuel storage tanks or liners for waste storage areas. After the remaining potential impacts have been identified and a preliminary assessment has been conducted, strategies to further avoid or mitigate the impacts are then developed. This may also include measures to enhance or optimize the potential benefits of the Project. The significance of the impacts is then re-evaluated based on these mitigation measures. The resulting impact is known as the 'residual' impact and represents the impact that will remain following the



application of mitigation and management measures, and thus the ultimate level of the impact associated with AR-SIPVPP Project. The general process which will be adopted for assessing potential Project impacts in the ESIA is illustrated in Figure 5-3.

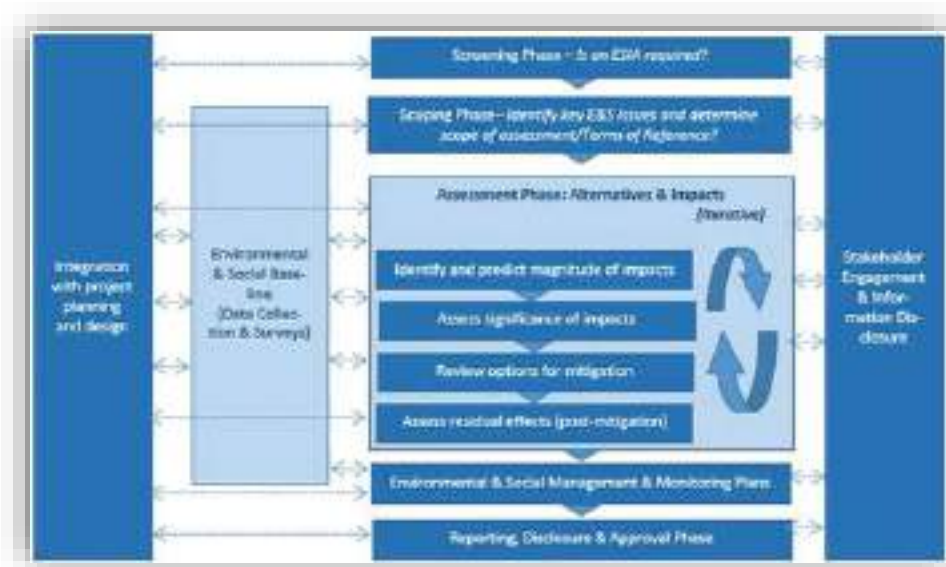


Figure 5-3 Impact Identification and Assessment Process

5.2.1 IFC Assessor's requirements

The ESIA scoping report has been reviewed by an ESIA Assessor appointed by ACWA Power Company (Saudi Listed Joint Stock Company)

The content of the report was assessed in accordance with IFC's Performance Standards (PS):

- Assessment and management of environmental and social risks and impacts;
- Labor and working conditions;
- Resource efficiency and pollution prevention;
- Community, health, safety, and security;
- Land acquisition and involuntary resettlement;
- Biodiversity conservation and sustainable management of living natural resources;
- Indigenous people; and
- Cultural heritage

5.2.2 Disciplines Scoped into the ESIA

Based on the outcomes of the Scoping process, and EBE's Project understanding and considerations of potential impacts and effects, the technical disciplines that are scoped-in for consideration during the ESIA are summarized in Table 5-1.



Table 5-1 Disciplines Scoped in to the ESIA

Discipline	Scoped (Yes/No)	Justification
<i>Climate</i>	GHG 's is addressed	AR-SIPVPP -CW will be undertaken over a short period and the associated GHG emissions are not of huge scale that is considered to have the potential to result in a significant effect on climate.
<i>Air quality</i>	Yes	Generation of emissions during AR-SIPVPP construction works (AR-SIPVPP -CW) have potential to affect the workforce. Operation of construction machinery such as Vessels, Barges, Excavators, Dredgers, Vehicles and generators and the daily vehicle movements that will be required to transport the construction workers during AR-SIPVPP -CW has the potential to result in significant effects for community in the area.
<i>Sound</i>	Yes	Operation of construction machinery such as Vessels, Barges, Excavators, Dredgers, Vehicles and generators and the daily vehicle movements that will be required to transport the construction workers during AR-SIPVPP -CW has the potential to result in significant effects.
<i>Geology and Soils</i>	Yes	Some ground stability concerns for the AR-SIPVPP were expected and if not managed appropriately could result in significant effects.
<i>Surface Water</i>	Yes	Storm Water discharges and outfalls may affect water quality and if not appropriately managed could result in significant effects.
<i>Terrestrial ecology</i>	Yes	Site clearance activities will cause a loss of habitats for avifauna, and if not managed properly could harm avifauna.
<i>Social</i>	Yes	AR-SIPVPP -CW will result in employment opportunities, as well as an influx of people into the area which would change the character of the area and could lead to pressure on local services/resources, conflict and competition with the incumbent population.
<i>Waste management</i>	Yes	It is anticipated that solid and liquid waste will be generated during AR-SIPVPP -CW, which if not appropriately managed have the potential to result in significant effects.
<i>Archaeology and cultural heritage</i>	Yes	AR-SIPVPP -CW could have direct physical impacts on archaeological remains and could lead to significant effects if not managed appropriately.
<i>Landscape and Visual</i>	Yes	Landscape effects associated with the AR-SIPVPP Project would relate to changes to the fabric, character, and quality of the landscape resource, and how it is experienced.

5.2.3 Disciplines scoped out of the ESIA

5.2.3.1.1 Traffic

The impact of vehicular traffic as a result of construction activities or new developments is assessed using detailed traffic information. The information required to assess the impact of traffic include; a number of vehicle movements, vehicle assignment, types of vehicles and the daily traffic profiles for all vehicle movements. This information is required for all movements that may



take place, such as construction vehicles, waste collection, delivery vehicles, staff vehicle movements, and user access/egress movements. At this stage, it is unknown what type of vehicles will access the study area, what route vehicles would take, what the daily profile or traffic is and where staff will be located in relation to the works area. AR-SIPVPP is located in the remote area where no Public and Private vehicles are moving and also AR-SIPVPP very few numbers of vehicles moving every day for construction works. The number of workers within the study area is also currently unknown (Depends upon AR-SIPVPP works); therefore, the volume of other vehicles such as service or waste collection vehicles is unknown. Given the forecast traffic information is unknown at this stage; it is not possible to undertake a meaningful impact assessment of the traffic associated with the AR-SIPVPP -CW. Once the details of the traffic information and population demands are known, a traffic assessment can be undertaken. It is therefore proposed to exclude traffic and transport from the ESIA until the traffic information is known. Traffic assumptions in terms of construction flows for the purposes of air and noise have been derived and are presented in the respective chapters.

5.2.3.1.2 Seismicity

Seismic impacts are considered a geotechnical issue. In the event of a seismic event impacts on hydrogeology, soil and geology are considered minor due to the negligible sensitivity. This is largely due to the groundwater environment.

5.2.3.1.3 Topography

There is Excavation, removal of soil grading and site clearance activities on shore of AR-SIPVPP will be undertaken and thus which will slightly alter change the topography of the AR-SIPVPP area.

5.2.3.1.4 Groundwater

Since most of AR-SIPVPP -CW are isolated and to a limited depth, which will not be of significance on Ground Water Quality

5.2.4 ESIA Study Area and Area of Influence

The Study Area for assessment of impacts is defined as the geographical boundary of the Project area and the extent within which potential impacts can occur. 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) (IFC, 2012). The AOI encompasses the area likely to be affected by the Project and includes both direct and indirect impacts. Both the Study Area and the AOI have been defined in each section of this report.



The following is the detail of the Substation and the OHTL: The impacts associated with this ESF are assessed together with the AR-SIPVPP. The construction impacts are similar to those from the construction of AR-SIPVPP. The transmission line impacts are addressed in the Mitigation section.

5.2.5 ‘Impacts’ versus ‘Effects’

In ESIA guidance the general consensus is that ‘*impacts*’ are defined as the changes resulting from an action, and ‘*effects*’ are defined as the consequences of impacts, taking into account the sensitivity of the receptor impacted. Example: consider a new bypass as a development proposal and the local landscape as the sensitive environmental resource, then an impact (i.e. the change arising from the development’s progression) could be the permanent loss of mature trees and hedgerows. An effect (i.e. the consequence of the impact) could be the opening of new views towards the new bypass or a change in the perception of local landscape character.

5.2.6 Project Aspects

Project aspects are defined as elements of the Project, either wholly or partially, which could incite any change to the existing environmental or social conditions, whether adverse or beneficial. In order to systematically identify Project aspects, the Project activities are restricted to AR-SIPVPP -CW only.

5.2.7 Receptors

Receptors are defined as an entity that receives a contaminant or pollutant from the Project activities and which may interact with or be affected by it. It can be water, air, a parcel of land, community, ecosystem or individual organism, human being or property. Potential receptors were identified by taking into consideration possible Project impacts through desktop as well as field-based studies and through stakeholder engagement activities. Based on the review of existing information, three high-level categories of receptors have been identified:

- **Physical Environment** (e.g., climate, air quality, sediment and water quality);
- **Biological Environment** (e.g., flora and fauna); and
- **Social Environment** (communities, social groups and individuals, e.g., vulnerable groups or exposure to Project health and safety risks). Individual receptors identified within these categories are presented in Table 5-2, and were assessed as part of the impact assessment for their sensitivity to the potential impacts of the AR-SIPVPP Project.

Table 5-2 Environmental and Social Receptors with the Potential to be impacted by the Works Project



Medium	Environmental Component	Environmental and Social Receptors
Physical Environment	Air	Regional / Global Climate
Ambient Air Quality		
Ambient Light		
Ambient Sound & Vibrations		
Ambient Light		
Surface Water Quality		
Ground Water Quality		
Ambient Sound / Vibrations (limited)		
Biological Environment	Flora, Fauna and Protected Areas	Fish Communities (limited)
Terrestrial Environment		
Reptiles		
Avifauna		
Herpetofauna		
Other Protected Species		
Protected / Sensitive Areas		
Social Environment	Social & Economic Aspects	Local Communities - Health and Safety
Local Communities – Disturbance		
Visual Amenity (Landscape)		
Cultural Heritage		
Navigation/Traffic and Transport		
Public Infrastructure		
Economy		

5.2.8 Identification of Potential Impacts

In order to determine what potential impacts may be, an analysis of the Project activities and their potential interactions with environmental and social receptors has been conducted using modeling, where applicable and/or by applying professional judgment and experience.

The evaluation seeks to assess the significance of each impact on the receiving environment by considering the magnitude of the impact with the sensitivity of the identified receptors. The criteria for establishing impact magnitude, receptor sensitivity and impact significance are described below.

5.2.9 Impact Magnitude

The magnitude of a given impact is a measure of the degree of change from the baseline conditions. Impact magnitude is determined based on a number of criteria as outlined in Table 5-3. Each parameter is assigned a rating to help determine the overall level of the magnitude.

Table 5-3 Impact Magnitude Criteria Quantitative Definitions

Parameter	Definition	Criteria Rating
Reversibility	<i>Temporary</i> – An impact from a Project activity that is reversible.	1



<i>Permanent</i> – An impact from a Project activity that is irreversible.	2	
Frequency	Occurs infrequently (i.e. less than 5 times)	1
Occurs repeatedly but intermittently (i.e. 5 to 15 times)	2	
Occurs frequently (i.e. greater than 15 times)	3	
Duration	<i>Short</i> – Project activities that are predicted to last only for a limited period (less than 1 month); and whose associated impact will cease on completion of the Project activity.	1
<i>Medium</i> – Impacts from Project activities that will last more than 1 month, but less than 3 months.	2	
<i>Long</i> – Impacts from Project activities that will occur longer than 3 months	3	
Geographical Extent (Area)	<i>Local</i> – Impacts that affect locally important resources or are restricted to a single (local) administrative area or local community (not widespread)	1
<i>Regional</i> – Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries (fairly widespread).	2	
<i>National</i> – Impacts that affect nationally important resources, affect an area that is of national importance/ protected or macro-economic consequences (widespread).	3	
<i>International</i> – Impacts that affect internationally important resources such as areas protected by international conventions or treaties and which may affect more than one country (including transboundary issues).	4	
Intensity	Intensity is defined as the degree of change, for example, the concentration of emission or discharge with respect to standards of acceptability that include applicable legislation and international guidance, its toxicity or potential for bioaccumulation, and its likely persistence in the environment. Ranges from:	
A low intensity event;	1	
A moderate intensity event;	2	
A high intensity event.	3	

The scores for each parameter are added together to give an overall score for the impact magnitude. Based on that quantitative assessment and the application of modelling results, where



applicable, and professional judgment, each Project aspect is assigned an impact magnitude (i.e. Negligible, Low, Medium or High), as outlined in Table 5-4.

Table 5-4 Impact Magnitude Rankings

Impact Magnitude	Score (Summed Parameter Rating)
Negligible	5-6
Low	7-9
Medium	10-12
High	13-15

5.2.10 Receptor Sensitivity

Receptors may be people, ecological, biological and physical components of the environment, or cultural sites. Receptor sensitivity considers how a particular receptor may be more or less susceptible to a given impact. More sensitive receptors may experience a greater degree of change, or have less ability to deal with the change, compared with less sensitive receptors that may be more resilient or adaptable. As with magnitude, the concept of receptor sensitivity is based on multiple characteristics, namely:

- **Vulnerability:** the degree to which a receptor is vulnerable to change (i.e. higher or lower sensitivity);
- **Value:** the degree to which a receptor is valued or protected, with higher value receptors (based on ecological, cultural, social, economic, or other grounds) having a higher sensitivity; and
- **Resilience:** the degree to which a receptor is able to recover from an impact. The sensitivity of a receptor may be rated as **negligible, low, moderate** or **high** (Table 5-5).

Table 5-5 Sensitivity Level Categories

Category	Level	Description
High	4	➤ <i>Biological:</i> Internationally threatened species/protected species or area which has little or no capacity to absorb or adapt to change within the area impacted by the project activities during period of high sensitivity (e.g. during breeding, spawning or nesting) and during routine or reliably predictable peak presence. ➤ <i>Physical:</i> The air, water or sediment resource has little or no capacity to absorb change without fundamentally altering its present character. ➤ <i>Social:</i> An already vulnerable social receptor with very little capacity and means to adapt to change and maintain/improve current conditions.
Medium	3	➤ <i>Biological:</i> Internationally threatened species/protected species or area, which has some capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to



		the project impact), within the area impacted by the project activities outside of period of high sensitivity or during routine or reliably predictable peak presence. ➤ <i>Biological:</i> Internationally near threatened species¹⁸ within the area impacted by the Project activities during period of high sensitivity (e.g. during breeding, spawning or nesting) and/or during routine or reliably predictable peak presence. ➤ <i>Biological:</i> Nationally protected species and/or species which are of importance to the local and regional ecosystem within the area impacted by the project activities. ➤ <i>Physical:</i> The air, water or sediment resource has some capacity to absorb change without fundamentally altering its present character. ➤ <i>Social:</i> A social receptor with limited capacity and means to adapt to change and maintain/improve current conditions. Adaptation may take time and / or may only be partial.
Low	2	➤ <i>Biological:</i> Non-threatened/protected species and/or abundant population which has a moderate to high capacity to absorb or adapt to change (i.e. has capacity to move away from or adapt to the project impact). <i>Physical:</i> The air, water or sediment receptor or resource has decent capacity to absorb change without significantly altering its present character. ➤ <i>Social:</i> A social receptor with some capacity and means to adapt to change and maintain/improve current conditions. Adaptation may take time and / or may only be partial.
Negligible	1	➤ <i>Biological:</i> Includes no sensitive/protected fauna and/or flora or an ecosystem that is not sensitive or that is already impacted. ➤ <i>Physical:</i> The air, water resource is tolerant of change without detriment to its character. ➤ <i>Social:</i> A social receptor with the capacity and means to adapt to change and maintain/improve current conditions.

5.2.11 Potential Effect Significance

Once the impact magnitude and receptor sensitivity are defined, the next step is to evaluate the significance of the potential effect. This is derived as a function of the identified magnitude of the anticipated impact and the sensitivity of the receptor using the matrix provided below in Table 5-6.

The significance matrix provides basic guidance for the determination of effect significance. However, the resulting significance level is also interpreted based on professional judgment and expertise, and adjusted if necessary.



Table 5-6 Effect Significance Matrix

		ACTIVITIES THAT MIGHT HAVE IMPACT																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ENVIRONMENTAL INVENTORY	LANDSCAPE	-1/3																			
	FLORA	-4/1					-2/2						-5/3								
	Demographics	-1/8	-2/3	-8/3	-6/1	-4/3							-4/3	-2/2				-4/4			
	Economic activities	-1/6	-5/4	-2/6	-1/8	-1/4							-4/3								
	Sea Fauna							-3/7	-7/1	-4/1	-1/1	-7/5			-1/1	-4/4					
	Birds	-2/1																	-1/2		
ENVIRONMENTAL INVENTORY	FAUNA																				
	POPULATION																				
	Energy source	1																			
	Freshwater production	2																			
	Production of cooling systems	3																			
	Mineral production	4																			
ENVIRONMENTAL INVENTORY	Lithium production	5																			
	CO ₂ emissions	6																			
	Dumping materials to the surface	7																			
	Artificial reef effect / contamination by heavy metal and salts influences	8																			
	Organism drag and compression influences	9																			
	Redistribution of ocean water bodies influences	10																			
ENVIRONMENTAL INVENTORY	Injury by organic and toxic substances influences	11																			
	Risks	12																			
	Lighting	13																			
	Turtle nesting alteration	14																			
	Birds discharge	15																			
	Causes socio-cultural impacts	16																			
ENVIRONMENTAL INVENTORY	Significant public controversy	17																			
	Migration routes interruption	18																			
	Waste	19																			
	Sewage discharges from the station	20																			

Using the matrix outlined in Table 5-6 allows the significance of the effect to be classified as **Negligible**, **Minor**, **Moderate** or **Major**. Table 5-7 below provides a qualitative definition of what the rating means.

Table 5-7 Effect Significance Definitions

Significance	Definitions
Major Significance	Potential or Residual Effects with a “ Major ” significance are predicted to have damaging and lasting changes to the functioning of a receptor and may have broader consequences (e.g. on ecosystem health). Potential impacts of Major Significance are a priority to avoid or reduce their significance to an acceptable level (i.e. Negligible or minor).
Moderate Significance	Potential or Residual Effects with a “ Moderate ” significance are predicted to be noticeable and result in lasting changes to or degradation of a receptor. Broader consequences for the ecosystem are not anticipated. Mitigation measures will be required to help reduce the identified impact to an acceptable level (i.e. negligible or minor).
Minor Significance	Potential or Residual Effects with a “ Minor ” significance are predicted to be noticeable changes to baseline conditions, beyond what would naturally occur, but are not expected to cause hardship or degradation. Although not considered significant in terms of their effect, potential impacts of Minor Significance still warrant the attention of decision-makers, and should be avoided or mitigated where practicable.
Negligible	Potential or Residual “ Negligible ” effects are expected to be indistinguishable from the baseline or within the natural level of variation within the Project timescales. These potential impacts do not require mitigation and are not a concern of the decision-making process.
Beneficial	Changes resulting in a positive, desirable or beneficial effect on a receptor



5.2.12 Presentation of Impact Assessment

For each identified effect, an impact assessment evaluation matrix has been provided which identifies the impact magnitude, receptor sensitivity and impact significance to help provide a clear presentation of the impact assessments as demonstrated in Table 5-8 below. The actual results of the potential impact assessment are included in the relevant sections of this report

Table 5-8 Example of Impact Summary Table

Description of the Project Aspects	Project Phase	Impact Magnitude Definition	Impact Magnitude Ranking	Receptors Sensitivity Ranking	Effect Significance
A summary of the Project aspects which may lead to an impact	Identifies which phases of the Project the impact relates to (i.e. construction, operation or decommissioning)	Outlines which categories of the impact magnitude parameters are applicable to the impact (as per Table 5-4)	Gives the rating for the impact magnitude based on the total score (as defined Table 5-5)	Gives the rating for the receptor sensitivity (based on the definitions provided in Table 5-6)	Defines the significance of the effect, (using the matrix provided in Table 5-7)

5.2.13 Mitigation and Management Measures

Where a major adverse significance impact is identified, strategies will be developed to primarily avoid (e.g. through the design process) or minimize the impact. The selection of mitigation measures has considered a standard mitigation hierarchy (Figure 5-2), in line with IFC PS1, whereby preference is given to avoiding impacts altogether and subsequently to minimizing the impact, repairing its effects, and/or offsetting the impact through actions in other areas. Mitigation measures are framed by reference to Good International Industry Practice (GIIP) and Best Available Techniques (BAT), where applicable. Mitigation and management measures will be captured in the framework Construction Environmental and Social Management Plan (CESMP). The framework CESMP will outline all of the impact mitigation and management requirements to be implemented during the course of project implementation, and including, where necessary decommissioning. The appointed mitigation measures will be controlled by a Work Method Statement, which will align with the CEMPs, be produced under the supervision of the Contractor's Environmental Officer and reviewed and approved by the Supervision Consultant's Environmental Manager. These mitigation measures are considered in addition to those already built into the Project design.

5.2.14 Residual Impacts

After suitable mitigation measures have been identified, the significance of each impact is re-evaluated to predict the post-mitigation ('residual') significance (i.e. the impact that remains after



additional mitigation). It is this residual significance that is used to support decision making and conclusions about the Project.

5.2.15 Cumulative, Unplanned Events and Trans boundary Impact Assessment

In addition to the core assessment and management of the potential impacts of the Project, the ESIA Report will also assess a number of other types of potential impacts including:

- **In-Combination effects:** For the purpose of this ESIA, in-combination effects are determined when we consider the interaction between separate residual impacts associated with the Project where the potential to cause a greater impact together than when considered in isolation;
- **Cumulative impacts:** While an impact may be relatively small when considering the Project on its own, the impact may be magnified in combination with impacts from other existing and/ or reasonably foreseeable future developments; these combined effects are known as ‘cumulative’ impacts. A cumulative impact is an impact that results from incremental changes caused by other past, present, or reasonably foreseeable actions by others outside of the Project scope together with those from the Project, for example, the incremental noise from a number of separate developments. When assessing the overall acceptability of a project, it is important that potential cumulative impacts are considered. The significance of cumulative impacts is evaluated qualitatively using the same method as the impact assessment. The cumulative assessment initially considers the potential for impact interaction and accumulation in terms of the following criteria:
 - **Temporal Overlap** – the impacts are either overlapping or so close in time that the effect of one is not dissipated before the next one occurs; and
 - **Spatial Overlap** – the impacts are either overlapping or so close in space that their effects overlap
- **Impacts from Unplanned events:** Impacts may also arise as a result of unplanned events (i.e. activities or events that are not anticipated to occur in the normal course of operations of the Project, including accidents and malfunctions). These impacts are also assessed as part of the ESIA process, along with measures to manage risks and respond to unplanned incidents (more information is provided in the section below); and
- **Transboundary Impacts:** Transboundary impacts are those that may affect countries other than the country in which a project will be constructed and operated. The potential Trans boundary impacts of the Project (e.g. on Kuwait or Iraq) will, where appropriate, be



assessed as part of the main ESIA and will include consideration of planned and unplanned events.

5.2.16 Unplanned Events

Unplanned events are incidents, such as accidents and malfunctions that are not expected to occur during the Project's normal activities during construction, operation and decommissioning. Some unplanned events have the potential to result in a number of adverse impacts, varying in nature and magnitude depending on the type of event. The potential environmental and socio-economic impacts resulting from a range of unplanned events will be assessed within the ESIA, under a separate chapter. A preliminary list of the potential unplanned incidents includes:

- Damage to pipelines resulting in the release of effluent, fuel or other hazardous substances into the environment;
- Fire;
- Transportation incidents (e.g. during transport of construction materials); and
- Accidents and incidents with members of the community or wildlife. Although the likelihood of unplanned events is low, appropriate management plans will be developed and implemented to ensure that such impacts will be minimized and contained (e.g. development of a specific Emergency Preparedness Plan). Appropriate unplanned event contingency planning, therefore, minimizes the likelihood of remote probability events occurring, as well as minimizing the consequences of such events. The assessment of unplanned events considers the likelihood of the event occurring and the potential severity of the consequences to the environment if it does occur. Likelihood is judged on a qualitative basis considering the probability of an event occurring refer to Table 5-9). The Project has control measures built into its design to try and reduce the likelihood of an unplanned event happening but the assessment assumes that the chances of an event happening cannot wholly be ruled out.

Table 5-9 Likelihood (L) Level Categories for Unplanned Events

Likelihood (L)	Definition
Extremely Unlikely	The event is a rare event in the industry and therefore almost certainly not expected to occur during the Project's life cycle based on extensive design controls that have been incorporated into the Project design.
Unlikely	Due to the existing design control measures, the event is not expected to occur, but its occurrence at some time during the Project life cycle cannot be ruled out.
Possible	Despite the design controls in place, the event is likely to occur at some time during the Project life cycle. This usually relates to low severity events.



Likely	Despite the design controls in place, the event is expected to occur sometime during the Project life cycle. This usually relates to negligible or low severity events

The severity of the unplanned event is determined qualitatively by using the categories outlined in Table 5-10 below.

Table 5-10 Severity Level Categories for Unplanned Events

Severity	Definition
Negligible	Little or no damage to the environment Short term impact that is very localized and fully reversible
Low	Some damage to the environment that is very localized No sensitive receptors impacted Rapid degradation of spilled materials

Severity	Definition
	Rapid and full recovery of affected receptors
Medium	Fairly localized environmental damage Some sensitive receptors impacted Slow degradation of spilled materials Recovery of affected receptors is slow, but they do ultimately recover
High	Severe environmental damage Sensitive receptors impacted Slow or no degradation of spilled materials Recovery of affected receptors is very slow, or do not recover at all

Once the likelihood and severity are defined, the next step is to evaluate the significance of the unplanned impact. This is derived as a function of the likelihood against the severity of the event and is determined by using the matrix provided below in Table 5-11.

Table 5-11 Potential Unplanned Event Impact Significance

Likelihood of Impact	Severity of Impact				
		Negligible	Low	Medium	High
	Extremely Unlikely	Negligible	Negligible	Negligible	Minor
	Unlikely	Negligible	Minor	Minor or Moderate *	Moderate or Major*
	Possible	Negligible	Minor or	Moderate	Major
	Likely	Negligible or Minor *	Moderate *	Major	Major

Professional expertise will be used to determine the impact significance, selecting a single category for significance

5.2.17 Critical Habitat Assessment Screening

PS6 outlines specific requirements for projects located in areas identified as IFC natural and critical habitats, all of which have to be met in order for project activities to be permitted in such



areas. In natural habitats, mitigation measures should aim to achieve no net loss of biodiversity and in areas of critical habitat, the requirement is to achieve net gains for the biodiversity features that triggered critical habitat designation. A number of biodiversity focused documents are required to achieve these targets, providing a project can fulfil the requirements of PS6 paragraph 17. In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:

- No other viable alternatives within the region exist for the development of the project on modified or natural habitats that are not critical;
- The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
- The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; and
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

If a project cannot comply with these requirements project activities should not be undertaken and therefore, the Project will be required to robustly demonstrate how these requirements (detailed in **Section 3.3**, PS6 & GN6) have been taken into consideration and met in order to locate project activities in such habitats.

The Critical Habitat Assessment is carried out as a parallel independent process to the ESIA and will be concluded in due course. Given the timing of the proposed Project and the limited available design and baseline information, a screening-level assessment will be conducted.

5.3 References Documents

- IFC 2012. IFC Guidance Note 1 Assessment and Management of Environmental and Social Risks and Impacts.
- IFC 2013. Good Practice Handbook for cumulative impact assessment
- IUCN Red List Classification of Critically Endangered, Endangered or Vulnerable
- IUCN Red List Classification of Near Threatened



SECTION 6.0 STAKEHOLDER ENGAGEMENT FOR AR RASS SOLAR INDEPENDENT PV POWER PLANT (AR- SIPVPP), AR RASS PROJECT



SECTION 6.0 STAKEHOLDER ENGAGEMENT FOR AR RASS SOLAR INDEPENDENT PV POWER PLANT (AR-SIPVPP), AR RASS PROJECT

6.1 Introduction

There are no specific requirements for stakeholder engagement within KSA GERRI legislation, however, IFC PS1 and international good practice on stakeholder engagement does require disclosure of information during the ESIA process about the Project and its potential environmental and social impacts to affected people (None identified at Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass and to receive their feedback on the impacts and mitigation measures to address the impacts. Stakeholders need to be identified (including any vulnerable groups, e.g. elderly, disabled, minority ethnic groups, low-income households) and a stakeholder engagement plan (SEP) should be developed and grievance mechanism, established. Affected communities (If Any) should be given periodic updates on risks, impacts, mitigation and any concerns raised. Projects should maintain records of all stakeholder consultation, stakeholder complaints, and resolution. In addition, where stakeholder engagement is led by the government, the Project should collaborate with the government, to the extent permitted, to achieve outcomes consistent with PS1. If the government process does not meet PS1 requirements, the Project should conduct a complementary process of stakeholder engagement with supplementary actions. It is recognized that there may be cultural and political limitations to fully engaging with non-government stakeholders and members of the public. While such limitations should be respected by the Project, they also create gaps with the expectations of PS1. Such gaps should be addressed in a sensitive manner, using pragmatic approaches to engaging and consulting with potentially affected people (If any) and other stakeholders. In terms of the scheduling of stakeholder engagement activities, IFC PS1 stipulates that stakeholder should be consulted as early as possible, or at the latest prior to the commencement of construction. It further states that consultation should be iterative, that is an on-going process throughout the life of the Project. Stakeholder engagement should also allow for a feedback mechanism where if any affected people are able to present their concerns and grievances for consideration and redress.

Potential risks associated with not meeting IFC requirements for stakeholder engagement include:

- Reducing the accuracy of the ESIA by not obtaining community perspectives on potential impacts and mitigation;
- Reputational risk and potential project funding risks or delays in project funding if stakeholder engagement activities do not meet funder expectations; and



- Potential community resistance to the project if public do not feel they have been adequately informed or engaged. It is recommended that ACWA Power Company (Saudi Listed Joint Stock Company) consults with KSA authorities to identify the engagement activities they plan to undertake, then identify any gaps between the KSA standard approach and IFC requirements for stakeholder and community engagement and discuss and agree with KSA authorities how gaps can be addressed and any supplementary engagement activities that M/S ACWA Power Company (Saudi Listed Joint Stock Company) can undertake. A Stakeholder Engagement Framework (SEF) (Appendix A) has been developed for the ACWA Power Company (Saudi Listed Joint Stock Company) project as a whole, and any additional engagement activities to be undertaken in relation to specific Project components. This SEF identifies the objectives of the engagement, key issues to cover in engagement, key stakeholders to engage and the planned engagement activities by government authorities and Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass. This approach will help ensure that engagement that is relevant to the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass project as a whole is conducted centrally, and that engagement conducted by each ESIA is done in a coordinated way and is not repetitive or inconsistent.

6.1.1. Indigenous People (PS7)

The study methodology prevented Free Prior and Informed consent (FPIC), as an opportunity to engage prior to and during scoping. However, the Stakeholder Engagement section in the ESIA, appended to the report details good practice engagement requirements which are proposed to be considered and discussed with M/S ACWA Power Company (Saudi Listed Joint Stock Company)'s Chief Manager. There are no local Bedouins and there will not be any requirement of Compensation, Relocation etc. and no indigenous communities affected from ACWA Power Company (Saudi Listed Joint Stock Company) and therefore not triggering this PS 7 standard and subsequent actions.

6.2 Purpose of the Stakeholder Engagement Framework

The overall aim of the SEF is to ensure that a consistent, comprehensive, coordinated and culturally appropriate approach is taken to stakeholder engagement and project disclosure. It is intended to demonstrate the Proponent's commitment to fulfill the requirements of relevant KSA legislation, as well as adopting an international good practice approach to engagement (as prescribed by IFC PSs). To this end, the SEF:



- Outlines the approach to be adopted for engagement, and demonstrates how this will be integrated into the rest of the ESIA process;
- Guides the identification of stakeholders and mechanisms through which these stakeholders can be included in the process;
- Serves to provide a framework of the engagement process; and
- Identifies the Proponent's responsibilities with respect to KSA legislative requirements and the IFC PSs. The SEF focuses on stakeholder engagement approaches proposed for the ESIAs and should be expanded upon in the Stakeholder Engagement Plan (SEP) and for subsequent Project phases (e.g. operational and closure phases).

6.3 Objectives of Stakeholder Engagement

The objectives of engaging stakeholders during the ESIA process should include the following:

- **Ensuring understanding:** an open, inclusive and transparent process of culturally appropriate engagement and communication should be undertaken to ensure that stakeholders are well informed about the Project. Information should be disclosed as early and as comprehensively as possible.
- **Review of the ESIA report.** They should also play an important role in providing local knowledge and information as baseline data that should inform the impact assessment.
- **Building relationships:** through supporting open dialogue, engagement should help establish and maintain a productive relationship between the ESIA team and stakeholders; and eventually between stakeholders and the Proponent.
- **Engaging indigenous and vulnerable groups:** an open and inclusive approach to consultation increases the opportunity of stakeholders to provide comments on the Project and to voice their concerns. Some stakeholders, however, need special attention during such a process due to their vulnerability. Special measures should be considered to ensure that the perspectives of indigenous and vulnerable stakeholders are heard and considered.
- **Managing expectations:** it is important to ensure that the Project does not create or allow unrealistic expectations to develop amongst stakeholders about potential Project benefits. The engagement process should serve as a mechanism for understanding and managing stakeholder and community expectations, where the latter should be achieved by disseminating accurate information in an accessible way.
- **Ensuring compliance:** The stakeholder engagement process should be designed to ensure compliance with both local regulatory requirements and the IFC PSs. One of the key



outcomes of engagement should be free, prior and informed consultation with stakeholders, where this can be understood to be:

Involving stakeholders in the assessment: stakeholders should be included in the scoping of issues, the identification of impacts, the generation of mitigation and management measures.

- *free*: engagement free of external manipulation or coercion and intimidation;
- *prior*: engagement was undertaken in a timely way, for example, the timely disclosure of information before development is undertaken and or participation is sought regarding the identification of issues of concern; and
- *Informed*: engagement enabled by relevant, understandable and accessible information.

6.4 Approach to Stakeholder Engagement

All stakeholder engagement activities for the Project should be informed by an iterative approach to stakeholder identification and analysis. The overall objectives and approach to engagement are show in Figure 6-1.

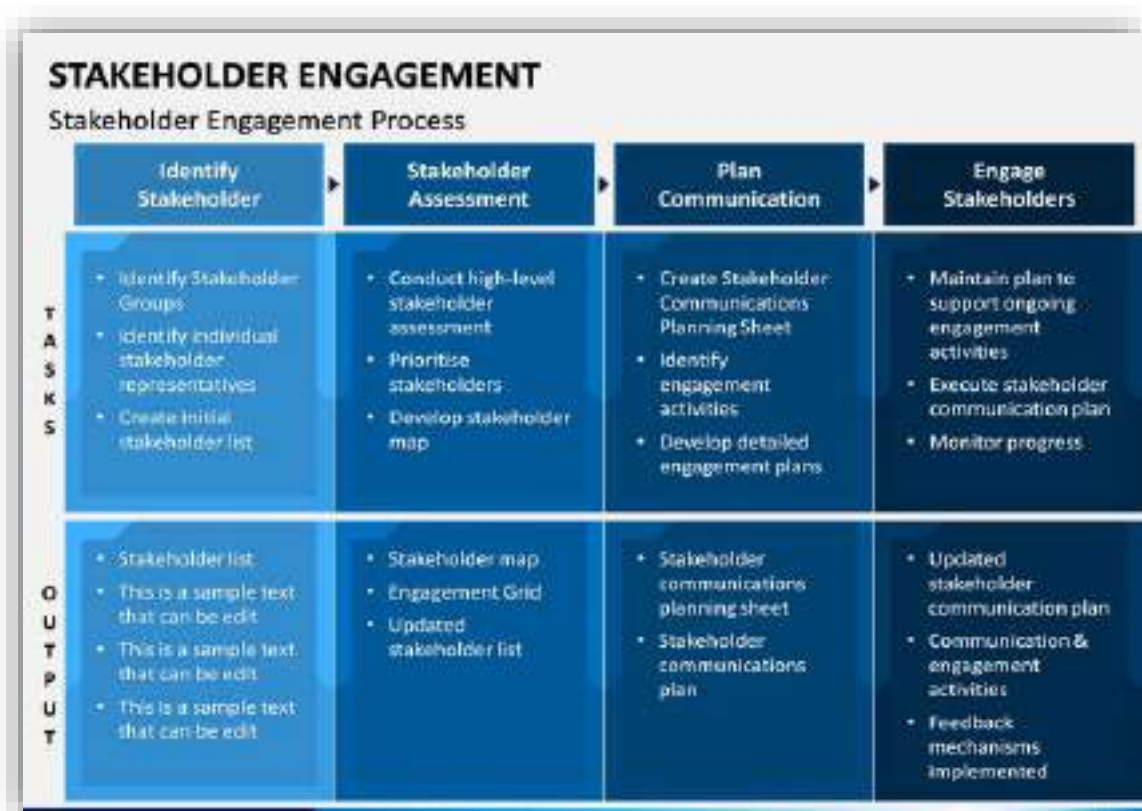


Figure 6-1 Approach to Stakeholder Engagement

The following steps described below (Table 6-1) are to be undertaken in compiling a SEP for the ESIA's for the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass project. All steps to be implemented should take cognizance of the principles of stakeholder engagement. The SEP to be developed should also link timeframes to the steps to be undertaken. The timeframes



for stakeholder engagement should be linked to the availability of reports and information as part of the ESIA process.

Table 6-1 Steps in the Development of a SEP

Steps to be Undertaken	Notes on Steps to be Undertaken
Identify Project stakeholders and their interest in the Project.	Compile a stakeholder database and analyze stakeholders' interests in the project.
Involve stakeholders in the scoping stage of the ESIA	The systematic identification of which impacts, and risks are to be assessed in the ESIA study can be greatly facilitated by involving project stakeholders (on a selective basis) in an initial process of "scoping." Scoping involves gathering primary information with an emphasis on listening to issues of greatest concern to stakeholders. Consultation during scoping is good practice and should be used to supplement research and assessments based on professional judgment and the review of secondary sources.
Involve stakeholders in the ESIA stage.	The ESIA Report and its relevant management plans will include potential project risks, mitigation measures and management plans. These documents will also include a draft Grievance Mechanism which should be disclosed to stakeholders for their views.

Stake Holders for Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project

- NCEC
- Ministry of Water, Environment and Agriculture
- Ministry of Interior
- Ministry of Petroleum and Mineral Resources
- Ministry of Energy
- Ministry of Finance
- Ministry of Tourism
- Ministry of Transport
- Municipality of Hail/Riyadh province
- SCTH
- NCWCD/ National Center for wildlife
- Saudi Geological Survey

6.5 Grievance Mechanism

Stakeholder engagement is a two-way process. Therefore, it is important to ensure that there is a grievance mechanism to allow stakeholders affected by or interested in the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project to present their input (e.g. opinions,



requests, suggestions, feedback, and grievances) for consideration and, if required, seek redress. It should be noted that, even where not all feedback or grievances are deemed ‘valid’ or applicable to the context of the Project, the grievance mechanism needs to function in a non-judgmental manner and record all communications received through the mechanism. In the case of this Project, there is a need for both a grievance and feedback mechanism.

The grievance mechanism allows stakeholders to provide feedback and raise comments and concerns throughout the ESIA process. Implementation of the grievance mechanism is the responsibility of the Proponent and should be designed to identify and manage issues throughout the entire Project lifecycle (beyond the ESIA process).

A grievance mechanism must be developed and should be communicated to stakeholders from the outset of the ESIA process. The grievance mechanism must be updated for the construction and operational phases of the project, as required.

6.6 Conclusions and Recommendations

It should be noted, that all stakeholder engagement that has occurred to date has fallen outside of the ESIA process between ACWA Power Company (Saudi Listed Joint Stock Company) and respective stakeholder groups due to cultural and political limitations and the lack of any enabling legislation. While such limitations should be respected by the Project, they create gaps with the expectations of PS1. Such gaps are being pursued as far as possible by ACWA Power Company (Saudi Listed Joint Stock Company) and fed back to the design programme. ESIA process stakeholder engagement has many benefits as it allows transparency in decision-making, good relations with host communities and it often builds a positive reputation for the developer nationally and potentially internationally. Thus, it is recommended that consideration of the SEF is given, engagement methods formalized, records kept and feedback looped back to planning and implementation of future phases of the ACWA Power Company (Saudi Listed Joint Stock Company) Project.



SECTION 7.0 AIR QUALITY



SECTION 7.0 AIR QUALITY

7.1 Introduction

This section considers the significance of potential air quality impacts on human health, amenity, and sensitive ecological habitats, relative to baseline conditions. It does so by estimating potential impacts against applicable air quality standards set out in Section 7.3. The key air quality effects anticipated during Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass construction Works (Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -CW) stage of the development are associated with:

- Dust generating activities such as excavations, construction of roads and the movement of vehicles on un surfaced roads; and
- Combustion emissions associated with any energy generation plant, site plant, and vehicle movements Key air quality effects during Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -CW of the development are detailed within

Section 7.2 Scoping

Operation of generators, plant and equipment, and the daily vehicle movements that will be required to transport materials and construction workers during Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -CW has the potential to result in significant effects. The assessment of Air Quality impacts from these AR-SIPVPP -CW has been scoped into this assessment. The key activities likely to generate emissions to air during the AR-SIPVPP -CW are included below in Table 7-1.

Table 7-1 Air Emissions from Activities of the AR-SIPVPP

Project Phase	Cause	Measurable Parameters
Physical Construction Works		
Site Clearance and Preparation Works	Operation of heavy machinery	Changes in Nitrogen dioxide (NO ₂), sulphur dioxide (SO ₂), carbon monoxide (CO), particulate matter less than 10 microns (PM ₁₀ and PM _{2.5}) and volatile organic compounds (VOCs)
	Construction activities including Excavation and Earth moving	Dust and PM ₁₀
Slope Stabilization and Erosion Control	Operation of heavy machinery & operation of on-site power generators	Changes in NO ₂ , SO ₂ , CO, PM ₁₀ , PM _{2.5} and VOCs
	Earth moving	Dust
Access and Temporary Roads	Operation of heavy machinery	Changes in NO ₂ , SO ₂ , CO, PM ₁₀ , PM _{2.5} and VOCs



Road Embankments	Operation of heavy machinery	Changes in NO ₂ , SO ₂ , CO, PM ₁₀ , PM _{2.5} and VOCs
	Earth moving	Dust
Enabling Works and Construction Compounds	Operation of heavy machinery	Changes in NO ₂ , SO ₂ , CO, PM ₁₀ , PM _{2.5} and VOCs
	Earth moving	Dust
Drainage Works	Operation of heavy machinery	Changes in NO ₂ , SO ₂ , CO, PM ₁₀ , PM _{2.5} and VOCs
	Earth moving	Dust
Removal and establishment of coastguard infrastructure	Operation of heavy machinery	Changes in NO ₂ , SO ₂ , CO, PM ₁₀ , PM _{2.5} and VOCs
	Earth moving	Dust
Construction Operations		
Access and Temporary Roads	Traffic emissions	Changes in NO ₂ , SO ₂ , CO, PM ₁ , PM _{2.5} and VOCs
Enabling Works and Construction Compounds	Combustion exhaust gases from generators.	Changes in NO ₂ , SO ₂ , CO, PM ₁₀ , PM _{2.5} and VOCs
	Fugitive emissions from septic and fuel storage tanks	VOCs and Hydrogen Sulphide (H ₂ S)

7.3 Legislative Framework for Air Quality

7.3.1 National Standards

7.3.1.1 Saudi Arabian National Framework

As stipulated under Article No. 32, the KSA Constitution (The Basic Law of Governance) set forth the requirement for environmental protection and preservation in the KSA with a brief statement of “The State Works for the preservation, protection, and improvement of the environment, and for the prevention of pollution”. The Constitution, however, did not include measures to achieve this. As such, the most comprehensive regulations addressing environmental issues in KSA is the General Environmental and Rules for Implementation (GERRI) – 28 Rajab 1422H, enacted by Royal Decree No. M/34 in 2001. This legislation sets forth a general regulatory framework for the prevention of pollution and contamination of land, air and water resources, and provides broad implementation tactics for the management and preservation of these resources. The legislation assigns responsibility for this to the Presidency of Meteorology and Environmental Protection, now NCEC. Particular reference is paid to all stakeholders involved in the service, industry, utility and other economic sectors, requiring their compliance to existing and future environmental stipulations, standards, and guidelines set forth by the NCEC in the Implementing Rules, appended in the environmental law.



In accordance with the GERRI, NCEC was charged with the overall responsibility of overseeing and enforcing all environmental affairs in KSA and a set of Environmental Standards were established.

7.3.1.2 National Guidelines

The environmental standards for air, noise, and water were updated in 2020, and granted a five-year grace period to correct their status. The Project Air Quality Standards for ambient air quality are provided in Table 7-2. These have been taken from the NCEC Ambient Air Quality Standards, 2014.

Table 7-2 Project Ambient Air Quality Standards

Parameter	Time-Weighted Average $\mu\text{g}/\text{m}^3$ (ppb)	Averaging Time	Number of allowable exceedances
Sulphur Dioxide (SO ₂)	730 (280) 365 (140) 80 (30)	1-hour 24-hour Annual	2 times per annum 1 time per annum N/A
Nitrogen Dioxide (NO ₂)	660 (350) 100 (50)	1-hour Annual	2 times per 30 days N/A
Particulate Matter (PM ₁₀)	340 80	24-hour Annual	24 times per annum (3) N/A
Fine Particulate Matter (PM _{2.5})	35 15	24-hour Annual	24 times per annum (4) N/A
Hydrogen Sulphide, (H ₂ S)	150 (100)	24-hour	10 times per annum
40 (30)	Annual	N/A	
Carbon Monoxide (CO)	40,000 (32,000) 10,000 (9,000)	1-hour 8-hour	2 times per 30 days 2 times per 30 days

Note:

- 1) Readings are averaged over the period indicated.
 - 2) For NCEC 2014 Compliance, violations will only be reportable where validated data is available for 98% of measurements
 - 3) The average 90th Percentile 24-hour concentration must not exceed 340 $\mu\text{g}/\text{Nm}^3$
 - 4) The average 90th Percentile 24-hour concentration must not exceed 35 $\mu\text{g}/\text{Nm}^3$
 - 5) References are from NCEC Regulations as specified:
- All NCEC 2014 standards are Time-Weighted Averages quoted in $\mu\text{g}/\text{Nm}^3$.

7.3.2 International Standards

7.3.2.1 WHO Guidelines

World Health Organization (WHO) Air Quality Guidelines Global Update, 2005, relevant to this ESIA set out in Table 7-3.



Table 7-3 WHO Ambient Air Quality Guidelines

Parameter	Time-Weighted Average µg/m ³	Averaging Time
Sulphur Dioxide (SO ₂)	500 20	10 minutes 24-hour
Nitrogen Dioxide (NO ₂)	200 40	1-hour Annual
Particulate Matter, PM ₁₀	50 20	24-hour Annual
Particulate Matter, PM _{2.5}	25 10	24-hour Annual
Ozone (O ₃)	100	8-hour daily maximum

7.4 Area of Influence and Spatial and Temporal Boundaries

The spatial extent of any impacts will be dependent on the source of air emissions and are defined according to the guidance document referenced in the following two paragraphs. The impacts of any change in road traffic emission are considered to be negligible at any receptor that is located outside of this zone of effect. Impacts within the 200m zone will depend on the number of additional vehicle movements and the associated vehicle exhaust emissions. For construction dust emissions, the Institute of Air Quality Management Guidance on the assessment of dust from demolition and construction, Version 1.1, 2016, uses a maximum assessment area of 350m from the dust generating area, typically defined as the total area of the site, in which impacts may occur. Outside of this area impacts due to construction work are considered to be negligible.

N-200 meters

S-200 meters

E-200 meters

W-200 meters

7.5 Baseline Methodology

7.5.1 Introduction

Due to the activities which are planned to take place in the AR-SIPVPP construction Works, it is expected that the following pollutants have been considered:

- Nitrogen oxides (NO_x) as nitrogen dioxide (NO₂);
- Sulphur dioxide (SO₂);
- Particulate matter less than 10 microns (PM₁₀);
- Particulate matter less than 2.5 microns (PM_{2.5});
- Carbon monoxide (CO);
- Hydrogen sulphide (H₂S); and



- Volatile organic compounds (VOCs)

7.5.2 Baseline Data

A suspended particulate matter PM_{10} , and some gases such as Carbon Monoxide and Sulfur Dioxide and Nitrogen Oxides are the most important indicators to study the atmospheric ambient air quality, and the noise intensity has a negative impact on humans and the environment at high levels.

In this report, the results of Environmental measurements that have been made for Two days, from 26/03/2023 to 27/03/2023 for the AR-SIPVPP Plant Project (figure 7-1) and comparing it with maximum limits allowed by the National Center for Environmental Compliance (NCEC).



Figure 7.1. Part of the project Site.

7.5.2.1 Site Description

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Plant site is located at the Ar Rass in Saudi Arabia.

The air quality monitoring was carried in March 2023 for ESIA study.

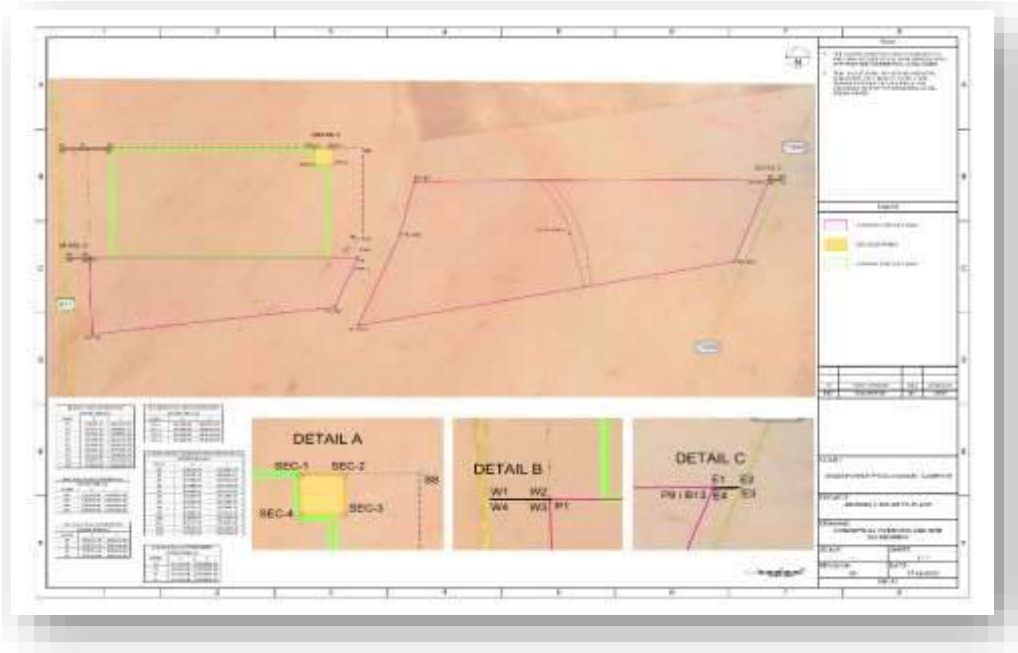


Figure 7.2. Study area.

7.5.2.2 Monitoring Locations

The below figure shows sampling locations for PM₁₀ fine particles, Ambient Air Gases, TVOC, Hydrocarbons, Heavy Metals and in the location map.

Ambient Air Gases and Hydrocarbons measurements were done by using Air Quality Mobile Station as mentioned in the below figure 7-3



Figure 7-3: Monitoring Locations at the AR-SIPVPP project Area

Measurement site: It is located within the boundaries of the project in the northeastern side, with coordinates of latitude 25° 03' 41.67" north and longitude 47° 33' 31.63" east. The sample was taken for 24 hours.

7.5.2.3 Objectives



The objectives of this report are:

Identify measuring data for Particulate Matter PM_{10} , Sulphur dioxide SO_2 , Nitrogen dioxide NO_2 , Carbon monoxide CO , Ozone O_3 , Hydrogen sulphide H_2S , and Noise.

This information will be helpful to understanding the Environmental Situation of the Project site.

7.5.2.4 Methodology and Monitoring process

7.5.2.4.1 Methodology Applied in Particulate Matter PM_{10}

Particulate matter PM_{10} measurement was carried out at the Project area by using the Genentech Fine Particulate SAMPLER GTI – 131 MFC shown in figure 7-4

GTI – 131 MFC $PM_{10}/PM_{2.5}$ Sampler is constituted of high finished anodized Impactors which are well designed for the sampling of PM_{10} as well as $PM_{2.5}$.

Design of both Impactors is adopted from published USEPA design. Design of Impactors is for air flow rate of $1m^3/hr$ or 16.7 lpm. This flow rate required to be constant at $16.7 \pm 5\%$ model GTI – 131 MFC uses a Diaphragm pump that produce needed suction. A microprocessor based flow controller maintain constant sampling flow rate at 16.7 lpm throughout sampling duration In the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass project the GTI – 131 MFC Sampler is used for the measurement of PM_{10} . One readings was taken at one locations for one day by using Fine Particulate SAMPLER GTI – 131 MFC. Sample location was selected according to the nature of site.



Figure 7.4: GTI – 131 MFC Sampler at the PM_{10} Monitoring location.

7.5.2.4.2 Methodology Applied in Ambient Air Gases (SO_2 , NO_2 , CO)

A. Serinus 50 Sulfur Dioxide Analyzer

- Automated Equivalent Method: EQSA-0809-188
- Sulphur Dioxide Analyzer



B. Serinus 30 Carbon Monoxide Analyzer

- Automated Reference Method: RFCA-0509-174
- Carbon Monoxide Analyzer

C. Serinus 40 Oxides of Nitrogen Analyzer

- Automated Reference Method: RFNA-0809-186
- Oxides of Nitrogen Analyzer

One reading was taken at two selected locations for one day for the duration of 24 hours, in which the sample location was selected according to the nature of site. Figure 7.5 as described below.

D. Weather elements

The measurement of weather factors and elements, namely temperature, humidity, wind speed, wind direction, and pressure, was performed during the monitoring process by Ecotech Weather Station installed at the top of the mobile laboratory

7.5.3 Monitoring Results

7.5.3.1 Particulate matter PM₁₀

As mentioned earlier, two readings were taken in two locations for 24 hours per site. The following table (Table 7-6) shows the results of the average concentration of Particulate matter 10 particles over 24 hours, where the concentrations of PM₁₀ particles in the first location was 117.01 $\mu\text{g}/\text{m}^3$

Table 7.6. 24-Hour average concentration particulate matter 10 results

NCEC Limit	Concentration $\mu\text{g}/\text{m}^3$	Site
340	54.42	Measurement site

Comparing the levels of particulate matter PM₁₀ at monitoring locations and the maximum limits allowed by the National Center for Environmental Compliance (NCEC), which is 340 $\mu\text{g}/\text{m}^3$. The results were less than the limit allowed by NCEC.

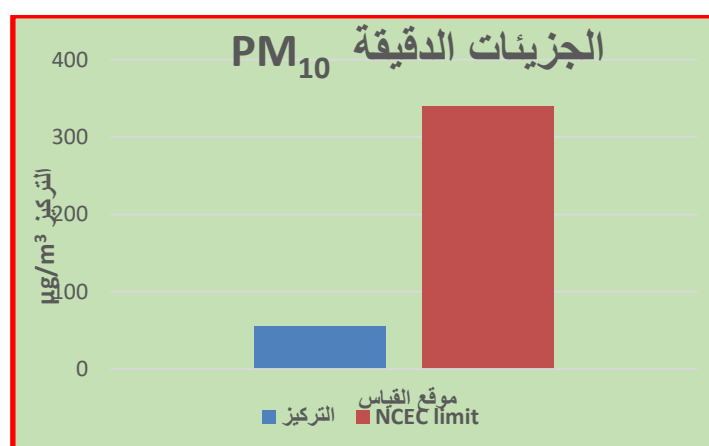


Figure 7.7. Graph showing the 24-hour average concentrations of PM₁₀ in comparison with the limits allowed by NCEC.



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لصاحبها: عبد الباع محمد جميل دقاق

الرجسٲر التجارى: 4030064992
الغرفة التجارية: 7391

Date: 3-04- 2023

PM₁₀/PM_{2.5} Combo Air Sampler/279-2022

Project / Location: ARRASS SOLAR PV IPP

Name: Engr. Mosab Matar

Air Quality monitoring (PM ₁₀)									
Date:	26/03/2023	to	27/03/2023	Duration	24 Hrs.	Start Time:	3:30 PM	End Time	3:30 PM
	Initial Weight (W _i)	Oven @ 103 ° c			Desiccator			Weight (W _i)	
Date	Filter Name	Start Time	End Time	Duration	Start Time	End Time	Duration	W _i	
05-03-2023		08:30 AM	09:30 AM	1 Hr.	09:30 AM	10:30 AM	1 Hr.	0.0984	
	1427								
	Final Weight (W _f)	Oven @ 103 ° c			Desiccator			Weight (W _i)	
Date	Filter Name	Start Time	End Time	Duration	Start Time	End Time	Duration	W _f	
3-04-2023		11:00 AM	12:00 PM	1 Hr.	12:00 PM	01:00 PM	1 Hr.	0.0997	
	1427								
							By Difference	0.0013	
Equation:				(Final Weight of filter - Initial weight of filter) µg / Total Volume of Air m ³					
Initial weight of filter:				98.4	mg				
Final Weight of filter:				99.7	mg				
Total Volume of Air Sampled:				23.89	m ³				
PM ₁₀ Concentration Contained in the sampled Air:				54.42	µg/m ³				

خدمات قياس انبعاث الملوثات من المصدر (المانعز) وجودة الهواء المحيط، تخطيط، تركيب وصيانة اجهزة الرصد ومختبرات مراقبة تلوث البيئة، متخصصون في برامج و نظم الأرصاد و البيئة، خدمات تقييم التأثيرات البيئية وإدارة التلوثات الخطرة.

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7.6 Impact Assessment and Mitigation

7.6.1 Impact Assessment Methodology

In setting the air quality standards referred to in this assessment, Table 7-2 and Table 7-3, the KSA and World Health Organization (WHO) have already taken into account the sensitivity of the human population's exposure to the pollutants considered. The purpose of the standards is to protect the health of the complete population including the very young, the elderly, and those with pre-existing health conditions. Therefore, the sensitivity of human health receptors in this air quality assessment is based on their likelihood of exposure to the pollutants considered, relative to the air quality standards. Some countries have separate standards for workforce exposure set in national law, which is typically an order of magnitude greater than the standards concerning ambient air quality and is not appropriate when assessing the impact of a proposed development on local populations and the environment.

7.6.2 Air quality impacts from construction works of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass

Potential impacts anticipated during construction of AR-SIPVPP Project

- **Creation of dust** – Demolition of livestock yard, store and ware houses, vehicle movements, excavations and the movement of construction material is likely to generate dust and sand movement. This will have an effect on local air quality and could have impacts on human health of workers at the site
- **Pollutants from vehicles, plants and generators** – emissions are likely to include Carbon Dioxide, Carbon Monoxide, Nitrogen Oxide, Volatile Organic Compounds, Sulphur Dioxide and particulates. Emission levels will depend on the type of vehicles/plant utilized and their condition and maintenance
- With respect to air quality, it was found that the potential sources of air pollutant releases from the construction phase of the proposed AR-SIPVPP Project, but considered that these would be of relatively of minor significance given the nature of the works.
- The release and dispersion of emissions from construction activities are typically localized and on site. Furthermore, the nature of the work means that the materials would be wetted, and the release of significant quantities of dry sand and/or dust into the air such that there would be on off-site effect is very unlikely and, therefore, no impact is predicted.

Potential impacts anticipated during Operation of AR-SIPVPP Project

- The operational phase of the AR-SIPVPP Project scheme is associated with air pollutant emissions from the generators, vehicles and facilities of AR-SIPVPP.



- Pollutants from operational AR-SIPVPP working equipment and from equipment, emissions are likely to include Carbon Dioxide, Carbon Monoxide, Nitrogen Oxide, Volatile Organic Compounds, Sulphur Dioxide and particulates. Emission levels will depend on the type of equipment and vehicles utilized and their condition and maintenance

Assessment of impact significance

Table 7.10-Assessment of air quality impact significance

Description of potential Impact	Receptor and its sensitivity	Magnitude of change from baseline	Significance (pre-mitigation)
Emissions from vehicles operating during construction impacting the health of workers	Receptor – People High – poor air quality could impact on the health of workers	Negligible – it is unlikely that many items of heavy duty plant will be operating at once generating a significant level of emissions	Minor adverse
Emissions from the AR-SIPVPP equipment once the site is operational impacting the health of workers	Receptor – People None	None	None

Table 7.11 Individual Air Quality Receptor Sensitivity to Particulate Emissions

Sensitivity	Dust Deposition	Human Health	Ecology
High	- Residential dwellings - Commercially sensitive land use, such as sensitive horticultural land	- Residential dwellings - Medical facilities - Schools	Locations with an international designation
Medium	- Places of work - Recreational/amenity areas	Offices and shops (but not including exposure covered by workplace regulations)	Locations with a national designation
Low	- Farmland that isn't horticultural sensitive - Public Rights of Way	- Recreational/amenity areas - Public Rights of Way	Locations with a local designation

Table 7-12 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM ₁₀ Concentration	Number of Receptors	Distance from Source				
			<20 metres	<50 metres	<100 metres	<200 metres	<350 metres
High	>20µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
Medium	1-20µg/m ³	>10	High	Medium	Low	Low	Low
		>1	Medium	Low	Low	Low	Low
Low	<1µg/m ³	>1	Low	Low	Low	Low	Low

Adapted from the IAQM Assessment methodology to reflect local conditions and assessment limits.



Note: Adapted from the IAQM Assessment methodology to reflect local conditions and assessment limits. Neither the KSA air quality standards or the WHO air quality guidelines include a standard for non-industrial dust (dust with limited silicon dioxide content) though both include standards for finer particulate matter (particulate with an aerodynamic diameter of less than 10 microns (PM10) and 2.5 microns (PM2.5)). It is not possible to model the dispersion of fugitive emissions from construction activity, due to uncertainty in dust and finer particulate emission rates, which vary depending on construction activity, methods and equipment used, and the characteristics of the surface and construction materials, including their moisture content. Instead, a qualitative assessment methodology has been undertaken to estimate the dust impact magnitude (risk of dust impacts occurring) as a result of construction activity proposed during demolition, earthworks/clearance and construction works. The method by which the impact magnitude is determined is summarized in Table 7-9 and is adapted from the Institute of Air Quality Management Guidance on the assessment of dust from demolition and construction, Version 1.1, 2016.

Table 7-11 Onsite Construction Equipment

Bulldozer	Road lorry	Concrete pump
Crusher	Diesel generator	Air Compressor
Wheeled loader	Mechanical water bowser	Backhoe loader
Tracked excavator	Tracked mobile crane	Welding set
Dump truck	Mobile telescopic crane	Compactor plate
Motor grader	Earthworks compactor /roller	JCB tractor
Road roller	Large lorry concrete mixer	Tilting drum mixer
Sheep footed roller/vibro roller	Fork lift truck	Fuel bowser
Asphalt paver	Water pump	Weighbridge

Onsite plant and vehicles and offsite vehicles will generate emissions of NO_x/NO₂, PM₁₀, PM_{2.5}, SO₂, CO and VOCs within the vicinity of the EW site. Impacts will be assessed in accordance with published guidance from the Highways England, The Design Manual for Roads and Bridges, Volume 11, Section 3, Air Quality (HA207/07) 2017, and Institute of Air Quality Management Guidance on the assessment of dust from demolition and construction, Version 1.1, 2016.

7.6.3 Recommended Mitigation measures to mitigate impacts of construction and operation of the AR-SIPVPP Project on the Air Quality of the project area

Following mitigation measures are recommended to address the potential impacts on air quality.

To control Dust Emissions

- Minimize the area of land to be disturbed at any one time by staging construction and maintenance activities;



- Dust generating vehicle loads transported to, from and on the proposed AR-SIPVPP Project site should be covered by tarpaulin sheets where potential for significant dust emissions exists and should not be overloaded;
- Installation of physical barrier during demolition to avoid dispersion of dust.
- Regular use of water trucks to suppress dust on high use site access and haul roads;
- Side enclosure and covering, by impervious sheeting where practicable, of any aggregate or other dusty material stockpiles, and placing of stockpiles in sheltered or covered areas;
- Cease earthworks and maintenance of plant during high winds in areas of visible dust generation, where dust is moving in the direction of accommodation areas or other sensitive land uses;
- Minimize drop height of excavated materials to a practicable level to limit fugitive dust generation;
- Fence work areas, with the fence lined with cloth or fabric (such as green garden type mesh) to minimize dust migration and generation off site;
- Undertake regular checks throughout the day by EPC Contractor's Site Manager's representative to visually inspect dust generation and to recommend mitigation measures.

Control of Exhaust Emissions

- A manifest of all machinery used (including date of manufacture, hours of operation, maintenance schedule, fuel type and emissions control devices installed) should be kept on site by the EPC Contractor's Site Manager;
- Proper and efficient use and operation of construction and maintenance vehicles, plant and machinery by qualified and skilled personnel (in accordance with the manufacturer's instructions);
- Use of appropriate fuels, including low sulphur diesel and unleaded petrol in accordance with the manufacturer's instructions;
- Regular maintenance and inspections for all construction and plant maintenance vehicles, plant and machinery (to be documented and checked by EPC Contractor's Site Manager's representative) in accordance with the manufacturer's instructions;
- Minimize unnecessary idling and operation of earthwork and construction and maintenance machinery, including efficiency of trip times and reduction of double handling through appropriate placement of stockpiles, haul roads, works depots and work areas. This will also aid in fuel efficiency and will assist in reducing overall costs associated with unnecessary fuel consumption;



- Daily visual checks by a representative of the EPC Contractor 's Site Manager to ensure the above criteria are followed, particularly in regards to smoky emissions from vehicles, vessels and plant; and
- Equipment with excessive visual emissions should be given defect notices and taken out of service until repaired and approved for redeployment by EPC Contractor's Site Manager.

The above mitigation measures will also assist in reducing the emissions of carbon dioxide and nitrogen dioxide, which are greenhouse gases.

Control of Volatile Emissions

The following management measures should be adopted during construction and operation to minimize the generation of volatile emissions from solvents paints and fuels stored or used at the AR-SIPVPP Project Site:

- Ensure all machinery is in good order and repair, and not leaking fuel or volatile emissions from fuel tanks or fuel lines;
- Existing controls associated with emissions from onsite and offsite construction plant and vehicles include:
- Use of ultra-low sulphur diesel where available;
- Diesel generators will be fitted with stacks to maximize dispersion;
- Construction plant and vehicles shall be modern and well maintained in accordance with the written procedures based on manufacturer's guidelines, applicable industry code, or engineering standard to ensure efficient and reliable operation.
- The number of fuel and chemical storage areas should be minimized and properly managed. A full list of all volatile fuels and chemicals stored on site should be kept by the EPC Contractor's Site Manager, including accompanying volumes, locations and Material Safety Data Sheets (MSDS);
- Ensure proper on-site storage of volatile fuels and chemicals in appropriately sealed containers, and in cool, covered areas with adequate venting. Avoid on site storage of highly volatile fuels, such as unleaded petrol, and volatile chemicals such, as solvents and oil- based paints.

The above measures will also assist in safety regarding the use and storage of dangerous goods.

Control of Odor

- To minimize potential odor emissions, there should be provision of appropriate temporary amenities for construction and maintenance laborers and visitors to the proposed AR-



SIPVPP Project site. Amenities should be well maintained and effluent storage facilities frequently emptied by a wastewater contractor for offsite treatment and disposal.

- Locate sites in an area where the nearest air quality sensitive receptors are over 350 meters away from the Project's construction site boundary and operational site boundary as far as practicable;
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials and cut down on vehicle movements as far as practicable;
- Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression, bag house, or cyclone);
- Use enclosed chutes and conveyors and covered skips;
- Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, using tackifiers and increasing the moisture content as appropriate;
- Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements;
- Selectively removing potential hazardous air pollutants, such as asbestos, from existing infrastructure prior to demolition;
- Managing emissions from mobile sources;
- No on-site burning of solid waste, all waste transported off-site to an appropriate waste handling facility;
- Reduce activities during high winds, particularly on dry days;
- Regularly water exposed and potentially dusty surfaces, such as exposed stockpiles, especially during dry and windy conditions if practical;
- Cover potentially dusty surfaces, such as exposed earthworks and stockpiles, during dry and windy conditions, if watering does not control emissions sufficiently or is inappropriate due to limited water supplies;
- Pave on site access roads as soon as possible;
- Where unsurfaced, the main access routes will be created using compacted well graded granular fill, appropriately designed to ensure good drainage to minimize the potential for erosion;
- All unsurfaced routes shall be regularly maintained to ensure the surface remains stable and compacted;



- Vehicles shall travel at speeds that minimize dust. Establish and enforce appropriate speeds dependent on the road surface, i.e. implement lower speeds on unpaved roads/tracks and dependent on load/vehicle type;
- All onsite vehicle routes to be marked on the road surface;
- Off-road driving shall be prohibited outside of designated areas unless specifically authorized;
- Where off road access is required, routes will be chosen to minimize damage and return journeys will be made along the same routes;
- Drivers of onsite construction vehicles shall be provided with dust management training;
- Loads of all construction vehicles entering/leaving the site shall be covered;
- Speed limits shall be adhered to at all times;
- Clean up spills on site and on the public road network as soon as possible;
- Undertake regular visual inspections at the construction site boundary and public roads close to the construction site boundary to check whether significant quantities of dust are depositing there. If so, revisit dust control measures and implement a dust monitoring regime;
- Construction activities shall be suspended if excessive dust arises and measures shall be taken to control ground prior to resuming activities;
- All hard-standing areas (including paved roads) shall be regularly inspected to ensure as are kept clean of dust and mud;
- Dust management options will be assessed and will include recommendations for monitoring. Periodic audits will be undertaken to confirm the effectiveness of measures to minimize dust. The audits will include observations of meteorological conditions including wind speed, direction, and general weather conditions;
- A wheel cleaning facility such as rumble strips shall be used for construction vehicles leaving the site prior to accessing the paved public road network;
- Spoil heaps to be inspected regularly to assess the condition and potential to generate dust;
- Quantity and duration of spoil exposure will be minimized as far as possible and ground disturbing activities shall be sequenced to minimize the area disturbed at one time; and
- Temporary or permanent stabilization of exposed soils will be provided to prevent washout of spoil by rainfall and generation of dust.
- Where practicable, mains electricity shall be used instead of mobile generators as a power source.



- All construction plant and vehicles shall be switched off whilst not in use and not left to idle.
- Compounds will be located as far from sensitive receptors as practicable with generators, chemical/ fuel storage tanks and septic tanks located as far from receptors and site welfare facilities and freshwater/ecological sites as possible;
- Chemical/ fuel storage tanks and septic tanks will be filtered with appropriate ventilation control measures, such as pressure relief valves to minimize breathing losses due to temperature changes within the tank or fill/empty air exchanges.
- Maximized the distance between site roads and sensitive location as far as practicable; and
- Locate junctions and intersections away from sensitive locations to minimize the impact on air quality due to slow traffic negotiating intersections.

7.7 Cumulative Impact Assessment

Cumulative impacts can occur where unrelated developments in the vicinity of Project-related emissions sources to air have the potential to impact on the same receptors. In this instance, there are several developments being undertaken within the vicinity of the AR-SIPVPP site that present a cumulative impact and given the moderate ambient air quality of the area, the cumulative impact is considered negligible.

7.8 Conclusions

Air quality in the area is considered to be well within the relevant standards in respect of the parameters as the AR-SIPVPP is located in coast and due to better dispersion; the air pollution is not significant. Therefore, any change in local air quality as a result of the proposed development is highly unlikely to result in an exceedance of the air quality standards set by the KSA or WHO or any other international standards. The CESMP must be implemented to reduce / control the air pollution during construction phase and operational phase. It is recommended to install a continuous air quality monitoring station.



SECTION 8.0 NOISE AND VIBRATION



SECTION 8.0 NOISE AND VIBRATION

8.1 Introduction

This chapter of the ESIA reports the findings of an assessment of the likely significant effects due to noise and vibration as a result of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Construction works associated with the AR-SIPVPP project. Anticipated AR-SIPVPP -CW are set out in detail in Section 3 Project Description and Alternatives. Noise surveys across the Project area were undertaken during March 2023 to establish the baseline noise environment in the surrounding areas in order to inform the assessments. This chapter identifies and proposes measures to address the potential impacts and likely significant effects of noise and vibration associated with the AR-SIPVPP -CW on local noise-sensitive receptors.

8.2 Scoping

Few previous noise survey campaigns or acoustic studies in the AR-SIPVPP Project area were identified. In order to establish the new baseline noise environment in the surrounding areas, baseline sound surveys were scoped in this assessment. Operation of generators, plant and equipment, and the daily vehicle movements that will be required to transport the construction workers during AR-SIPVPP -CW has the potential to result in significant effects. Noise from these AR-SIPVPP -CW has been scoped in this assessment. Vibration effects due to construction works are typically only experienced when receptors are located within 20m of heavy ground works activities (e.g., excavation, breaking, piling), and at greater distances vibration levels will dissipate such that there is minimal human response. Note that these types of heavy construction works are not considered as part of the AR-SIPVPP -CW and based on the AR-SIPVPP -CW locations and relative distances to existing sensitive receptors and occupied buildings, it is considered that any vibration emissions from AR-SIPVPP -CW will not be perceptible and does not have the potential to result in significant effects. Vibration from AR-SIPVPP -CW has been scoped out of this assessment. As the AR-SIPVPP -CW are for preparation of the site. There will be noise associated with operational activities. Assessment of the operational phase has been scoped in this assessment. This chapter assesses noise effects on human receptors, and excludes the assessment of noise on ecological receptors. In-combination effects on local ecological receptors due to the introduction of the proposed development are assessed in Section 12 Terrestrial Ecology. Assessment of noise effects on ecological receptors has been scoped out of this assessment.

8.3 Legislative Framework



Relevant legal framework and guidance documents to the assessment of AR-SIPVPP -CW noise effects are discussed below.

8.3.1 National Standards

The Kingdom of Saudi Arabia National Environmental Standard – General Environmental Standard for Noise (2020) sets out the basis for statutory control to restrict and reduce the nuisance caused by environmental noise in KSA. The standards relate to the following type of environmental noise: community noise, noise from industrial units, noise from construction, noise from vehicles and noise from equipment used outdoors.

8.3.2 International Standards

The World Bank Group/International Finance Corporation (IFC) General EHS Guideline: Environmental – Noise Management – 1.7 Noise (2012) is an internationally recognized guideline document containing information for the assessment and management of noise. It also presents noise level criterion values applicable to sites such as the proposed Project and procedures for noise monitoring to establishing existing ambient noise levels in the area of a proposed AR-SIPVPP development. British Standard (BS) 5228:2009+A1:2014 ‘Code of practice for noise and vibration control on construction and open sites – Part 1: Noise’ gives recommendations for basic methods of noise control relating to construction sites, including sites where demolition, remediation, ground treatment or related civil engineering works are being carried out, and open sites, where work activities/operations generate significant noise levels, including industry-specific guidance. This part of BS 5228 provides guidance concerning methods of predicting and measuring noise and assessing its impact on those exposed to it. BS 7445-1:2003 ‘Description and measurement of environmental noise – Part 1: Guide to quantities and procedures’ defines parameters, procedures, and instrumentation required for noise measurement and analysis. BS 7445-1:2003 also includes descriptive guidance for the consideration of meteorological conditions, selection of measurement positions, and information to be reported. The above standards are considered best practice.

8.4 Spatial and Temporal Boundaries

The nearest noise-sensitive receptors are AR-SIPVPP, - site offices, facilities Storage Yards, Parking areas, etc. are identified.

8.5 Baseline Methodology

8.5.1 Introduction

This section presents the methodology and results of baseline noise surveys carried out across the Project area in March 2023.



8.5.2 Data Gap Analysis

A gap analysis of existing data has identified no previous noise survey campaigns or acoustic studies in the AR-SIPVPP -Project area in specific.

8.5.3 Baseline Data Collection Methods

Baseline noise surveys were undertaken to inform the noise assessment studies. The surveys were carried out to establish the baseline noise environment at nearby sensitive receptors and the surrounding areas. The measurements have been carried out to determine the ‘representative’ noise environment, i.e., the typical noise environment that would normally be experienced at that location. Observation notes of the contributory noise sources were made during the measurements in order to accurately describe the sound scope at each measurement location. Baseline surveys have been carried out following the principles of environmental noise measurements as detailed in the IFC Noise guidance and the KSA General Environmental Standard for Noise in line with BS 7445-1:2003 methodology. Figure 8.1 presents the noise monitoring locations. Survey locations are illustrated in Figure 8-1.



Figure 8-1 Baseline Noise Locations

Measurements at each selected location included:

- Daytime noise measurement between 07:00 and 19:00 of 1-hour duration.
- Night-time measurement between 23:00 and 07:00 of 1-hour duration. The measurements consisted of the following sound level parameters, as defined in BS 7445-1:2003:



- Average sound level LAeq, T is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval T.
- Background sound level LA90, T is the A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval T.

8.5.4 Methodology Applied in Noise

8.5.4.1 Pulsar Sound Level Meter

The Noise intensity has a negative impact on humans and the environment at high levels. Exposure to prolonged or excessive noise may lead to range of health problems ranging from stress, poor concentration, and productivity losses in the workplace, communication difficulties and fatigue from lack of sleep, to more serious issues such as cardiovascular disease, cognitive impairment, tinnitus and hearing loss.

Pulsar decibel reader use for environmental and industrial noise monitoring and provide either an automatic or manual sweep through the filter bands in a measurement duration of as little as 1 minute for the 1:1 Octave Band Filters. The frequency measurements are automatically time and date stamped with the 1:1 Octave Band Filters. Up to 12 days of 1 second time history can be stored. Weatherproof kits available for outdoor long-term monitoring

Features

A high performance integrating averaging sound level meter with additional key features including:

- Range 20dB(A) to 140dB(A) & 143dB(C)
- Real-time 1:1 Octave band filters
- TWA/dose and Ln values
- Data Logging and Analyzer Plus software
- Audio recording, Audio Note, and Automatic Timers

Applications:

Ideal for compliant occupational, industrial, construction noise assessments and environmental noise pollution measurements

Environmental Noise Pollution measurement at its best

The Pulsar Model 45 Environmental Noise Meter is an extremely accurate, reliable, handheld precision instrument that is especially suited to measuring noise pollution. It successfully combines the latest technology in noise measurement methods with ease of use and durability. It can also be used for measuring noise across many different applications: noise at work, construction, entertainment, environment and for measuring machinery and vehicle noise. Compliant with IEC 61672-1:2002



8.5.5 Methodology for Determining Sensitive Receptors

Potential sensitive receptors have been taken into consideration when assessing the effects associated with noise and vibration emissions from the construction works. A number of receptors have been considered in this assessment that may potentially be affected. The assessment has selected groups of properties and communities as receptors which may be affected by noise (Working staff during operation of AR-SIPVPP), as identified in the Scoping Report. As the Project progresses and more detail is made available, any properties that are later identified and have the potential to be significantly affected by noise and/or vibration will be further considered in the design of the construction and operational phases.

8.6 Baseline Characteristics

Given the nature of the Project area in KSA, there are notable sources of anthropogenic sound such as industrial facilities, busy traffic routes, and AR-SIPVPP Plant operations were identified. The main sound sources at the locations of AR-SIPVPP -CW are therefore considered to be natural ambient sounds e.g., waves crashing on the AR-SIPVPP. In the main locations of works, ambient noise levels are relatively low, showing 62.6 & 63.6 dB LAeq. The higher levels of noise is due to typical urban sound sources such as road traffic. Results of the baseline noise surveys are presented in Table 8-1.

As previously explained, the noise intensity was measured at one location for measurement periods for 24 hours, the result of these measurements is shown in Table 8.1 below.

Table 8.1. Noise measurement results

NCEC criteria	Noise dB (Leq,)	Measurement period	Site
70	50.9	Night	First Location - Northwest
65	43.1	At night	
70	52.3	Night	Location II- Southwest
65	47.9	At night	
70	54.0	Night	Third Location- Southeast
65	30.2	At night	
70	49.0	Night	Location IV- Northeast
65	44.8	At night	



By comparing the measured noise intensity levels study area, we find that it is less than the maximum permissible NCEC in morning time, and slightly higher and nearly equal in evening time, which is 79 decibels in the day and 62 decibels in the evening. The following figure (Figure 8.2) shows a comparison of the measured noise intensity compared to the maximum permissible NCEC.

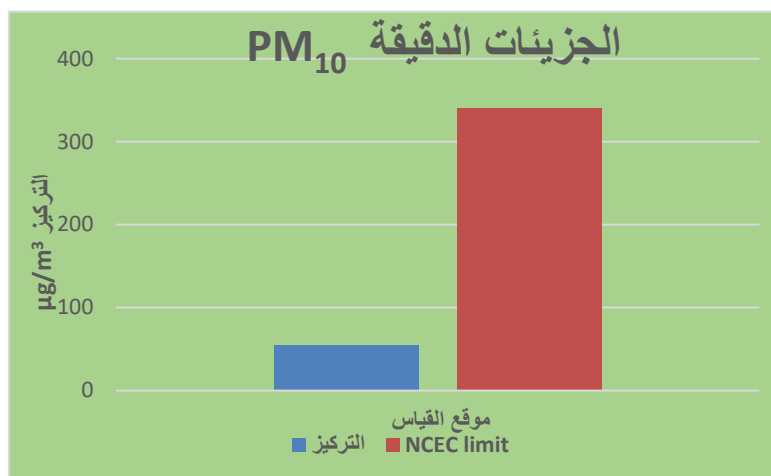


Figure 8.2. Graph showing the Noise Intensity are compared to the limit allowed by NCEC

8.7 Impact Assessment

8.7.1 Impact Assessment Methodology

KSA General Environmental Standard for Noise guidelines for permissible construction noise emissions affecting receptors are presented in Table 8-2.

Major industries in the area currently operating. Near to Traffic and wind are contributing to noise emissions in the area. Noise emissions from these projects are generally limited to the individual site boundaries and immediate vicinity and are of short term.

There are no residential or community facilities near the AR-SIPVPP Project area or near the Project. The closest population centers are at Ar Rass 25km from the site. To establish existing noise baseline, a noise survey was conducted in March 2023, at 4 locations at AR-SIPVPP Project site.

Legal and other Requirements

The RFP prescribes maximum noise pressure levels for various locations in the AR-SIPVPP Project. In 2020 NCEC updated standards / The standards for noise are prescribed.

Noise is an occupational hazard which in the long term can result in hearing loss and therefore the necessary preventive and protective measures should be provided. The IFC Performance Standard No 2, 'Labor and Working Conditions' requirements to provide the workers with a safe and



healthy work environment taking into consideration the inherent risks and specific hazards in the work areas applies to the AR-SIPVPP Project. As the term 'Pollution' in the IFC Performance Standards also refers to Noise, the IFC Performance Standard No 3 'Pollution Prevention and Abatement' applies to the AR-SIPVPP.



Dakkak Trading Group

Owner: Abdulbadea M.G Dakkak

Commercial Registration 4030026550
Chamber of Commerce 7391



مجموعة مؤسسات الدقاق للتجارة والمقاولات

لصاحبها: عبدالبدع محمد جميل دقاق

السجل التجاري: 4030064992
الغرفة التجارية: 7391

NOISE MONITORING: AR RASS SOLAR PV IPP, LOC3(25°35'43.04"N, 43° 42'43.63"E)													
DAYTIME													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/26/2023	11:45 AM	00:15:00	58.5	88.0	26.8	69.4	63.3	59.6	51.7	40.7	37.5	33.4	PN1709
3/26/2023	12:00 PM	00:15:00	53.1	69.2	28.0	60.3	56.1	54.5	52.7	44.8	40.5	34.8	PN1709
3/26/2023	12:15 PM	00:15:00	52.2	73.4	27.8	58.3	54.0	53.7	52.0	43.9	40.2	34.9	PN1709
3/26/2023	12:30 PM	00:15:00	52.0	73.2	28.7	58.2	53.9	53.6	51.7	43.6	40.1	35.0	PN1709
	Average		54.0	76.0	27.8	61.6	56.8	55.4	52.0	43.3	39.6	34.5	
EVENING													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/27/2023	3:00 AM	00:15:00	28.4	51.7	22.5	36.7	32.0	29.8	25.7	23.9	23.7	23.3	PN1709
3/27/2023	3:15 AM	00:15:00	32.2	54.3	22.8	41.3	38.6	36.4	27.4	24.9	24.4	23.8	PN1709
3/27/2023	3:30 AM	00:15:00	29.3	49.2	23.4	38.0	33.7	31.1	26.9	25.2	24.9	24.4	PN1709
3/27/2023	3:45 AM	00:15:00	30.9	49.9	24.6	39.3	35.3	33.4	28.6	26.5	26.2	25.7	PN1709
	Average		30.2	51.3	23.3	38.8	34.9	32.7	27.2	25.1	24.8	24.3	

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السجل التجاري: 4030064992
الغرفة التجارية: 7391

NOISE MONITORING: AR RASS SOLAR PV IPP, LOC2(25°34'42.28"N, 43° 34'19.27"E)

DAYTIME													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/26/2023	10:00 AM	00:15:00	51.8	71.3	33.0	58.8	55.1	54.7	47.6	42.5	41.8	40.5	PN1709
3/26/2023	10:15 AM	00:15:00	50.8	72.5	30.0	63.5	56.4	52.1	42.5	37.9	35.9	32.0	PN1709
3/26/2023	10:30 AM	00:15:00	53.7	73.3	26.8	66.5	61.0	56.8	38.7	32.5	30.8	29.1	PN1709
3/26/2023	10:45 AM	00:15:00	52.9	72.5	27.3	65.7	59.8	55.1	41.1	33.7	31.9	29.7	PN1709
	Average		52.3	72.4	29.3	63.6	58.1	54.7	42.5	36.7	35.1	32.8	
EVENING													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/27/2023	1:45 AM	00:15:00	48.5	67.6	44.9	49.9	49.4	49.3	48.7	46.1	45.9	45.5	PN1709
3/27/2023	2:00 AM	00:15:00	47.5	49.7	45.5	48.8	48.4	48.2	47.4	46.6	46.5	46.2	PN1709
3/27/2023	2:15 AM	00:15:00	47.7	56.9	45.1	50.1	48.6	48.3	47.5	46.6	46.3	46.0	PN1709
3/27/2023	2:30 AM	00:15:00	48.0	65.5	45.2	51.6	50.2	49.7	47.1	46.4	46.2	45.9	PN1709
	Average		47.9	59.9	45.2	50.1	49.2	48.9	47.7	46.4	46.2	45.9	

خدمات قياس التلوثات من المصدر (الداخلين) وجودة الهواء المحيط، تخطيط، تركيب وصيانة أجهزة الرصد ومقاييس مراقبة تلوث البيئة، متخصصون في برامج ونظم الأرصاد و البيئة، خدمات تقييم التلوثات الجوية وإدارة التلوثات الخطرة.

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السجل التجاري 4030064992
الفرقة التجارية 7391

NOISE MONITORING: AR RASS SOLAR PV IPP, LOC1(25°37'05.27"N, 43° 34'17.58"E)

DAYTIME													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/26/2023	9:00 AM	00:15:00	52.7	75.4	39.7	63.7	57.5	54.5	46.2	41.2	40.9	40.6	PN1709
3/26/2023	9:15 AM	00:15:00	45.0	65.2	34.6	53.3	49.3	46.8	42.9	41.6	41.4	41.0	PN1709
3/26/2023	9:30 AM	00:15:00	45.7	60.7	37.5	53.0	49.2	47.4	44.4	41.9	41.5	41.1	PN1709
3/26/2023	9:45 AM	00:15:00	60.3	75.3	41.8	72.2	68.1	64.2	50.6	44.4	43.4	42.6	PN1709
	Average		50.9	69.2	38.4	60.6	56.0	53.2	46.0	42.3	41.8	41.3	
EVENING													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/26/2023	11:45 PM	00:15:00	47.7	82.1	38.3	53.6	43.3	42.7	41.3	40.0	39.8	39.4	PN1709
3/27/2023	12:00 AM	00:15:00	41.6	47.2	39.1	44.5	43.1	42.6	41.3	40.3	40.1	39.7	PN1709
3/27/2023	12:15 AM	00:15:00	40.9	43.5	38.9	42.3	41.8	41.5	40.8	40.1	39.9	39.7	PN1709
3/27/2023	12:30 AM	00:15:00	42.0	54.1	39.1	49.9	42.3	41.8	41.0	40.3	40.2	39.9	PN1709
	Average		43.1	56.7	38.9	47.6	42.6	42.2	41.1	40.2	40.0	39.7	

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Chamber of Commerce 7391



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لصاحبها: عبدالبدع محمد جميل دقاق

السجل التجاري: 4030064992
الغرفة التجارية: 7391

NOISE MONITORING: AR RASS SOLAR PV IPP. LOC4(25°37'24.20"N, 43° 43'23.84"E)

DAYTIME													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/26/2023	1:00 PM	00:15:00	50.0	69.4	28.2	57.1	55.7	53.9	47.7	44.4	41.8	35.7	PN1709
3/26/2023	1:15 PM	00:15:00	48.1	71.3	27.2	53.9	49.8	48.7	47.4	43.7	41.1	35.3	PN1709
3/26/2023	1:30 PM	00:15:00	48.5	74.3	27.1	55.8	51.3	49.8	47.1	41.0	38.0	33.8	PN1709
3/26/2023	1:45 PM	00:15:00	49.5	72.7	27.8	58.4	53.9	51.8	46.9	38.9	36.4	32.9	PN1709
	Average		49.0	71.9	27.6	56.3	52.7	51.1	47.3	42.0	39.3	34.4	
EVENING													
Date	Time	Duration	LAeq (dB)	LAFMax (dB)	LAFMin (dB)	LAF1 (dB)	LAF5 (dB)	LAF10 (dB)	LAF50 (dB)	LAF90 (dB)	LAF95 (dB)	LAF99 (dB)	Instrument
3/27/2023	4:15 AM	00:15:00	47.9	71.9	40.8	61.2	50.8	44.9	42.9	41.8	41.6	41.3	PN1709
3/27/2023	4:30 AM	00:15:00	42.0	44.3	40.5	43.3	42.8	42.5	41.8	41.3	41.2	40.9	PN1709
3/27/2023	4:45 AM	00:15:00	47.2	69.0	40.3	59.1	48.0	44.7	41.6	41.1	41.0	40.8	PN1709
3/27/2023	5:00 AM	00:15:00	41.9	45.5	40.1	43.2	42.8	42.8	41.7	41.2	41.0	40.8	PN1709
	Average		44.8	57.7	40.4	51.7	46.1	43.7	42.0	41.4	41.2	41.0	

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As the requirements stated for ‘Occupational Health and Safety’ in IFC Performance Standard No 2 above extends to the communities, the IFC Performance Standard No 3 ‘Community, Health, Safety and Security’ applies to the AR-SIPVPP Project. Preventive and control measures need to be implemented in all phases of the project (i.e., from design to operation) considering ambient conditions.

Table 8-2 General Construction Maximum Permissible Noise Limits

Area classification	Daytime LAeq,12h (dB)	Evening LAeq,4h (dB)	Night LAeq,12h (dB)
- Places of worship, important tourist attractions, recreational park land and those areas surrounding hospitals, schools and noise sensitive natural habitats. - Residential properties (including hostels and hotels). - Commercial, retail and financial receptors.	75	65	45
- Areas with few residential or commercial properties. - Industrial cities. - Land that is generally unpopulated.	80	80	80

The magnitude of the impact of construction noise has been derived from the KSA General Environmental Standard for Noise limits presented in Table 8-2, and the semantic scale for the description of construction noise impacts is shown in Table 8-3.

Table 8-3 Magnitude of Construction Noise Impacts

Magnitude of Impact	Description
Negligible	Construction noise levels less than measured ambient LAeq noise level
Low	Construction noise levels exceeding ambient LAeq noise level, but not exceeding General Standard limits
Medium	Construction noise levels not exceeding 5 dB above General Standard limits
High	Construction noise levels exceeding 5 dB above General Standard limits

Note to table: Where pre-construction ambient levels exceed the General Standard Limits, the ambient level shall be used as the applicable limit. Sensitive receptors have been classed depending on their use and subsequent sensitivity to noise as per the Saudi Arabia General Environmental Standard for Noise guidelines. The sensitivity of receptors to noise is been defined in Table 8-4.

Table 8-4 Criteria Used to Define Sensitivity of Receptors

Sensitivity	Description
Negligible	Non-sensitive – The final classification of the district is a predominantly industrial area where there are few residential properties and commercial premises. This classification also applies to industrial cities and land that is generally unpopulated.
Low	Mixed – This designation applies to mixed areas, often within cities where there is a mix of residential and commercial activities. This designation will also apply to retail and financial districts of cities.



Medium	Sensitive – Areas designated in this category will typically be dominated by residential properties (including hostels and hotels) and may range from sparse population densities to suburban districts.
High	Quiet areas – These areas are designated quiet areas as they hold value in terms of them being places of worship, important tourist attractions, recreational park land and those areas surrounding hospitals, schools and noise sensitive natural habitats.

The significance matrix in Table 5-7 Effect Significance Matrix provides the methodology for the determination of impact significance.

8.7.2 Impacts from Noise generation

Environmental Concerns

Environmental concerns from the construction phase of the AR-SIPVPP Project include impact on ambient noise from:

- Site preparation and grading and other construction activities (excavation, earthmoving and sand/soil heap removal activities)
- Piling operations
- Heavy machinery, generators, excavators and compressors
- Graders Dozers
- Vehicular traffic

Environmental concerns from the operational phase of the AR-SIPVPP Project

None: Only noise from AR-SIPVPP operation equipment

Construction Phase Impact Assessment

The construction phase of AR-SIPVPP Project will involve site preparation activities such as clearing, backfilling, grading, leveling, and foundation work including piling. The construction activities will involve intensive use of heavy machinery, equipment, and tools that will result in a temporary surge in noise emissions. Use of generators and compressors are expected during the construction phase contributing significantly to temporary noise levels.

According to an Engineering Section Report by the Workers Compensation Board of British Columbia (Canada), noise levels were measured for plant/equipment and trades/tools. Tables 8.5 below present typical noise emissions from selected sources for construction equipment and trades/tools, respectively, in the above-mentioned report.

Additionally, transportation of machinery, supplies, construction material and debris, etc. will involve vehicular traffic thereby contributing to existing noise levels. For the most part, noise emissions during the construction phase will be localized to the AR-SIPVPP Project site and its periphery. Noise emissions from the movement of construction trucks and other project related vehicles will add to the existing noise levels in the surrounding areas apart from the AR-SIPVPP



Project area. Overall, the temporary increase in noise emissions is not expected to last beyond the construction phase and therefore is not considered significant.

Operations Phase Impact Assessment

None: Only noise from Only noise from AR-SIPVPP operation equipment

Table 8-5 Construction Equipment and Sound Power Levels

Onsite Construction Equipment	BS 5228-1 Reference	Sound Power Level L _w , dB(A)
Bulldozer	C2.1	103
Crusher	C1.14	109
Wheeled loader	C2.8	96
Tracked excavator	C1.12	110
Dump truck	C2.30	107
Motor grader	C6.31	115
Road roller	C5.19	108
Sheep footed roller/vibro roller	C5.20	103
Asphalt paver	C5.30	104
Road lorry	C2.34	108
Diesel generator	C4.76	89
Mechanical water bowser	C6.37	109
Tracked mobile crane	C3.28	95
Mobile telescopic crane	C4.39	105
Earthworks compactor /roller	C2.38	102
Large lorry concrete mixer	C4.18	103
Fork lift truck	D7.93	104
Water pump	C2.45	93
Concrete pump	C3.25	106
Air Compressor	D7.9	102
Backhoe loader	C2.8	96
Welding set	C3.31	101
Compactor plate	C2.41	108
JCB tractor	C4.74	108
Tilting drum mixer	C4.23	90
Fuel bowser	C6.36	117

8.8 Mitigation

The following measures will be adopted where reasonably practicable during construction phases to minimize noise levels at the receptor locations.

- Daily plant and equipment inspections to identify any maintenance requirements;
- Careful planning of the sequence of work in order to minimize the transfer of noise/vibration to neighbors;
- Careful handling of materials and waste such as lowering rather than dropping items;
- Avoidance of unnecessary noise (such as engines idling between operations, shouting, loud radios or excessive revving of engines) by effective site management;



- Where control at source is not practicable or adequate, the distance between noise/vibration sources and sensitive neighbors would be maximized and the transmission path interrupted, with options considered in the order of source-pathway-receptor. Where practical this can be achieved by:
 - Siting of stationary plant and loading/unloading areas;
 - Breaking of concrete will be undertaken using hydraulic pulveriser 'muncher' techniques where possible;
 - Static plant/equipment (e.g. compressors and generators) will be fitted with suitable enclosures
 - screening and sited away from sensitive facades;
 - When plant is not being used it will be shut down and not left to idle; and
 - Diesel equipment will be avoided where possible and substituted with an electric alternative.
- Methods and programme of work and vehicular routes will be selected with regard to minimizing noise and vibration impact;
- Site personnel will be instructed on methods to reduce noise and vibration as part of their induction training and as required prior to specific work activities;
- Careful handling of tools, placement, and shouting on the site will be covered in activity plans and/or briefings as appropriate; and
- Training and briefings will be delivered to the site team to inform them of noise and vibration issues and the location of nearby receptors. Consideration will also be given to traffic routing, timing and access points to the site so as to minimize noise impacts at existing receptors following contractor appointment, and as construction working methods are developed. Contractors will issue a project route map and delivery schedule to control construction traffic. Traffic management will be employed to guide and control both public and construction traffic during deliveries. Construction traffic will be scheduled outside of night time hours where possible. The effectiveness of the application of mitigation measures is dependent on the construction methodology and the appointed construction contractor. Consequently, the potential reduction in noise as a result of the mitigation measures cannot be accurately quantified so unmitigated noise predictions have been undertaken and unmitigated noise effects have been identified.
- Ensure all plant, machinery and vehicles are regularly maintained and broken parts (such as mufflers) are replaced immediately;



- Ensure all plant, machinery and vehicles of EPC Contractor's and sub-contractors are operated efficiently and according to the manufacturer's specifications, by trained and qualified operators; and
- Development and implementation of appropriate safety measures for site personnel, including the provision of suitable hearing protection.
- Heavy trucks/Dump trucks, Dozers and Rollers should be maintained to be in good condition with properly fixed silencers.
- All noise producing project equipment, plants, generators, should be equipped with mufflers, air inlet, silencers where appropriate and any other shields or other noise reducing features in good operating condition. Mobile or fixed "package" equipment such as arc welders, air compressors, shall be equipped with shrouds and noise control features that are readily available for such type of equipment.
- All mobile or fixed noise producing equipment used in the project and that is regulated for noise output by NCEC (2020) should comply with such regulation while in course of project activity.
- The erection of temporary sound wall barriers shall be considered where project activity is unavoidably close to noise receptors.
- Regular maintenance of construction equipment is conducted for assurance of mechanical performance. This includes the working performance of the fixed silencers.
- Material stockpiles and mobile equipment staging, parking and maintenance areas shall be located on far as practicable from noise sensitive receptors.
- Construction and maintenance site and haul road speed limits shall be established and enforced during the construction activities.

8.8.1 Construction Traffic Noise

Construction traffic movements along roads near AR-SIPVPP, when in close vicinity to a receptor, have the potential to cause temporary disturbance while it is passing by. It is therefore important that the routing and timing of vehicle movements are carefully managed. However, any increases in noise levels during AR-SIPVPP -CW will be temporary, relatively short term, and although the effect will be dependent on the actual number of traffic movements, it is considered that adverse effects can be managed and avoided. It is anticipated that the significance of construction traffic noise impacts will be negligible.



SECTION 9.0 GEOLOGY AND SOILS



SECTION 9.0 GEOLOGY AND SOILS

9.1 Introduction

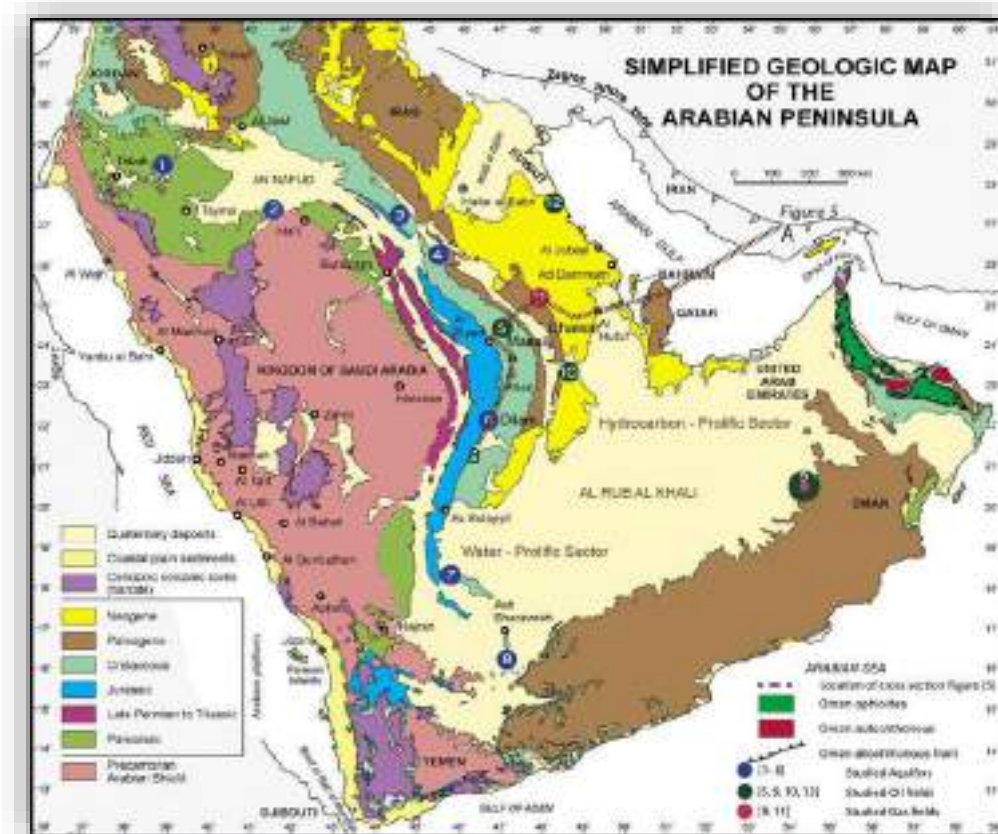
This chapter of the ESIA reports the findings of an assessment of the likely significant effects on soils and geology as a result of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass –CW associated with the AR-SIPVPP project.

9.2 Baseline

Geology: Geological history

Paleogeographic and stratigraphic data suggest the Arabian Gulf connected prior to the Cainozoic Era. During the Oligocene Era, a rapid increase in tectonic activity along a north –east /south-east trending fault caused the Saudi Arabian tectonic plate to move north-eastward away from the Asian plate. Structural features and magnetic anomalies for the area provide evidence that the movement of the Arabian plate has been rotational about a pivot point.

Progressive movement caused horst and graben fault and tilting along the eastern side of the Saudi Arabian plate, which accounts for the mountainous areas that parallel the coastline.



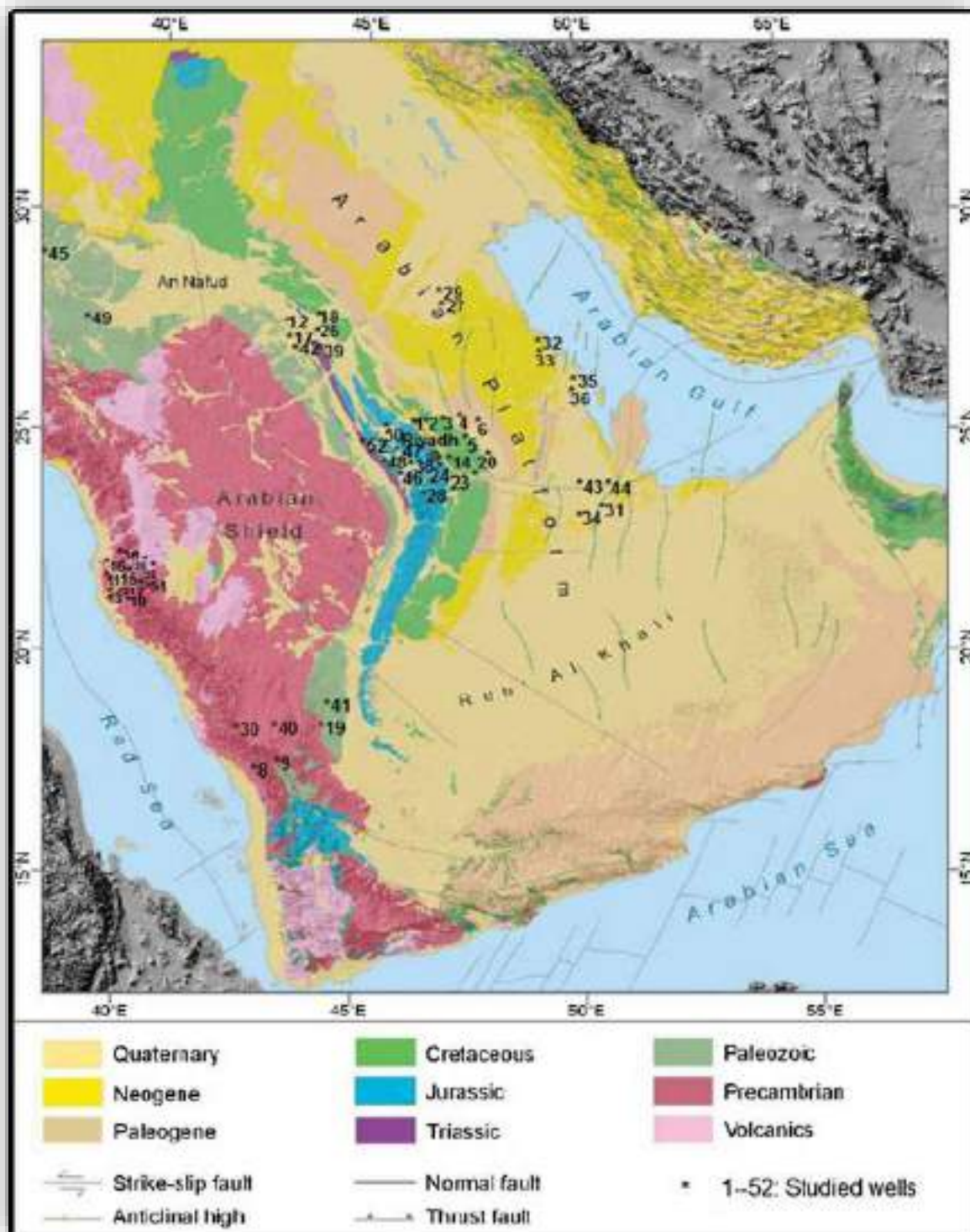


Figure 9.1 A & B : Geological Map of Saudi Arabia

During the Miocene Epoch, the Arabian Gulf is thought to have been periodically isolated, resulting in the formation of salt and halite deposits in the south. In the late Miocene and early Pliocene Epochs, the opening of the Arabian Gulf to the Indian Ocean was permanently established. The shallow waters of the Arabian Gulf resulted from deposition accompanied by



simultaneous fault throughout the Tertiary period, as well as from coral reef accumulation along horst edges of tilted blocks during the Pliocene, Pleistocene and recent epochs.

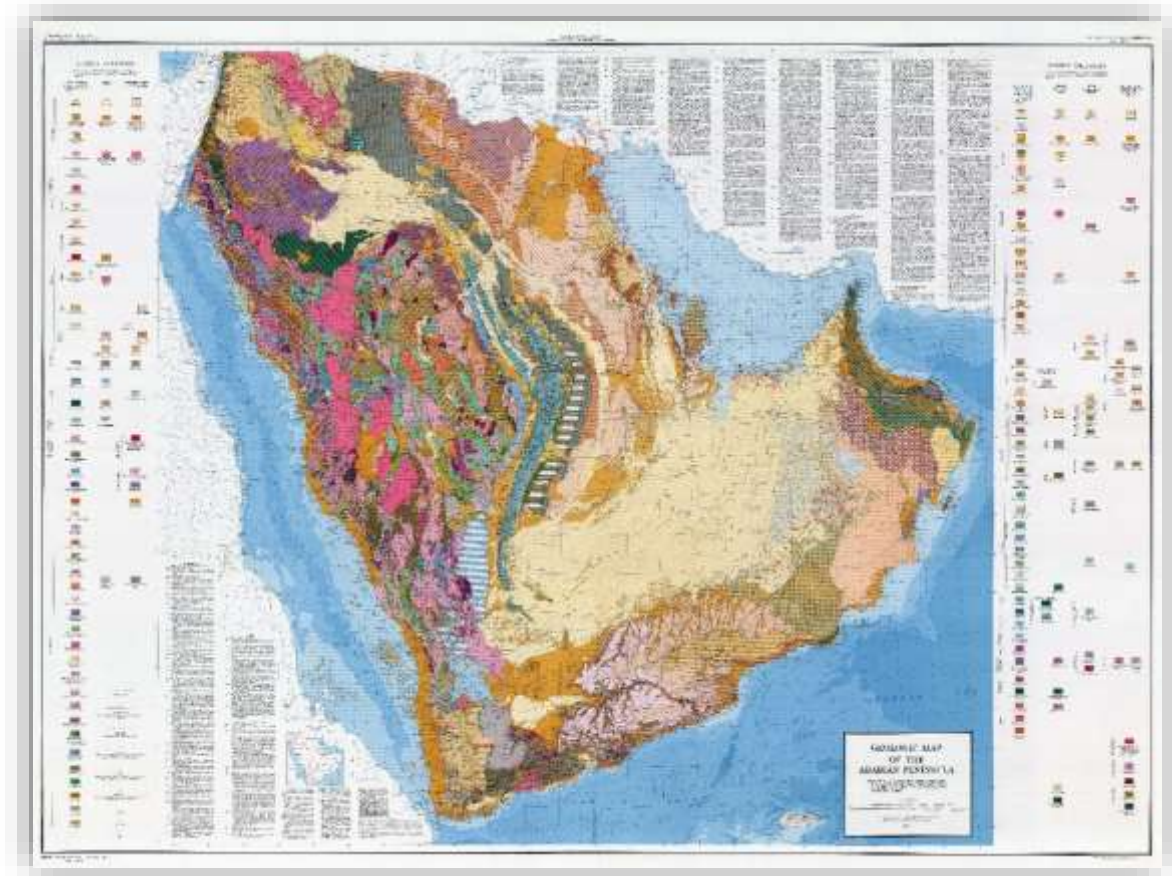


Figure 9.2 Geological Map of different regions of Saudi Arabia

The published geological map of the area (Ministry of Petroleum and Mineral Resources, 1989(d), together with the explanatory Memoir (Ministry of Petroleum and Mineral Resources, 1989(b) shows that the study area is underlain by a thin mantle of aeolian and alluvial sands of the plain and the Miocene Ubhur Formation (see Fig 5.27). The Ubhur Formation is generally comprised by clays, siltstone and soft white bioclastic limestone.

9.2.1 Seismological Data / Earthquake

In a study at Ar Rass It encompasses the evaluation of the site-specific seismic response parameters and the liquefaction potential for various possible subsurface conditions under the probable seismic event(s). The approach to achieve the objectives of this study included the following: analysis of geologic, hydrologic, and geotechnical data of the area; performance of field and laboratory dynamic testing; and dynamic modeling and analysis of the subsurface profiles. The results of the simulation have been used to develop liquefaction potential maps and site-specific spectra of the study area, consisting of ten seismic zones under a range of probable peak horizontal ground acceleration (PHA). Results do not show significant probability of



liquefaction of the loose soil layers in the study area at the maximum possible design PHA of 0.035 g; however, liquefaction is anticipated at higher PHA values. Site-specific spectral response resulted in values of Ss and S1 spectral accelerations to be different as compared to those suggested by local standards. The resulting seismic micro-zonation maps and the corresponding parameters are very useful for the stability analysis of the existing and planned structures in the Ar Rass area.

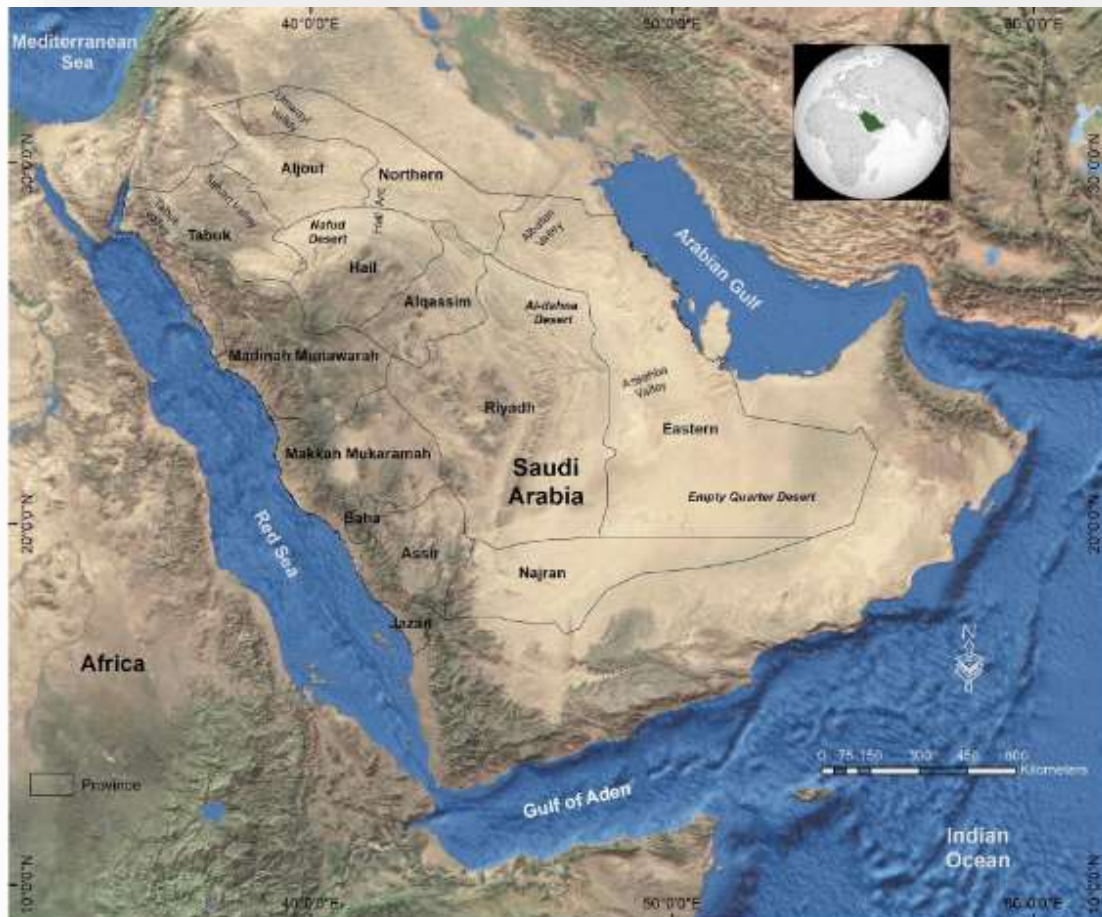
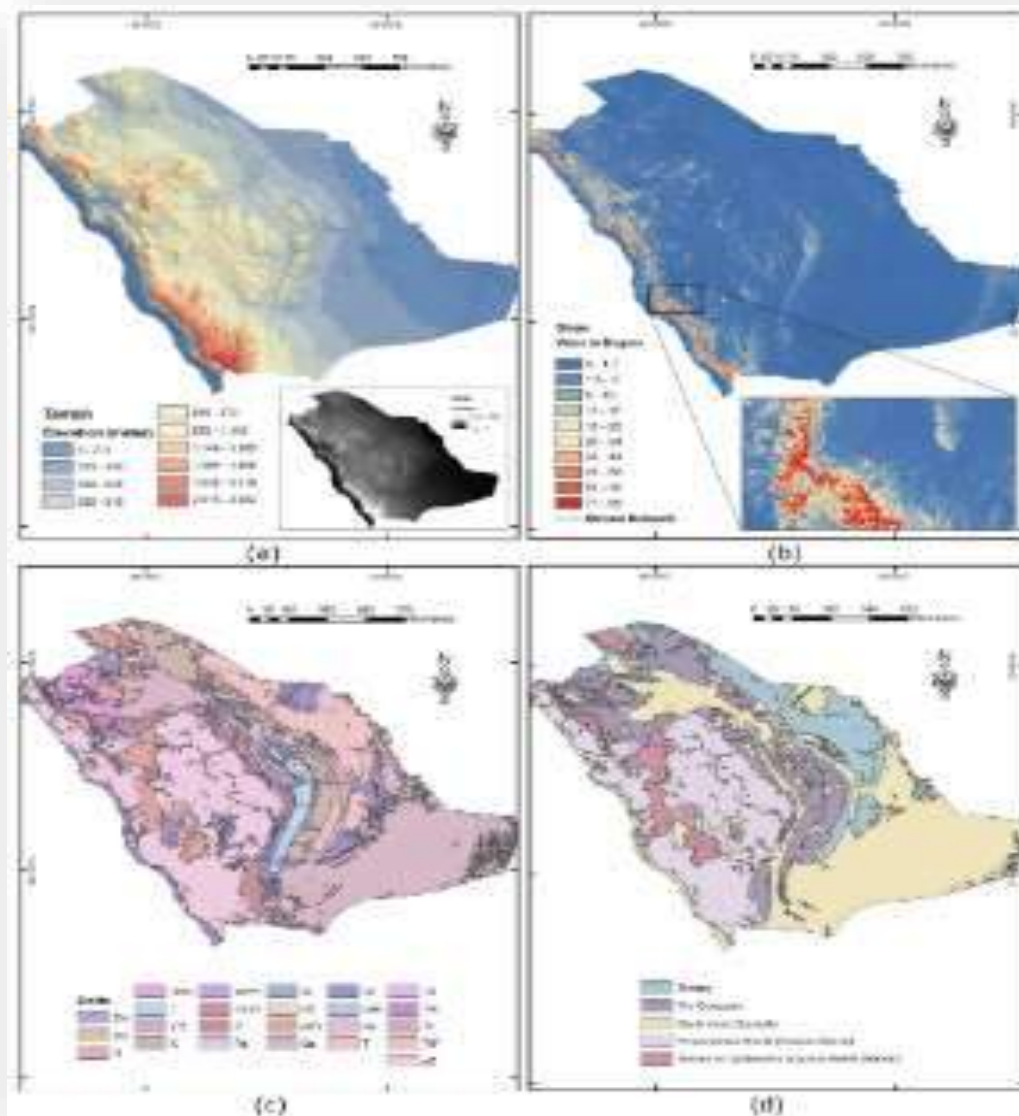


Fig. 1. Map showing the location of Saudi Arabia and its provinces.

Figure 9.5 Vicinity map of Ar Rass area (Seismic behavior and zoning of the soils near Ar Rass)



9.3 Project Area Soils and Geology

The predominant landforms at the south of proposed AR-SIPVPP Project area could be Categorized as follows:

- ⇒ Rocky area
- ⇒ Muddy Flats
- ⇒ Red Soil

The Project area Soils and Geology is presented in detail in Section 4.0 Environmental Baseline of AR-SIPVPP Project

9.3.1 Legal and Other Requirements

The requirement of the AR-SIPVPP to be designed, constructed, operated, and maintained in such a way that any soil contamination will be prevented. NCEC has explicitly required measures to



prevent soil and groundwater contamination as outlined in Article 13 the GERRI 2001. Fines and penalties have been stipulated by NCEC for violations to the requirements. No international treaties or other obligations are identified with regard to Geology and Soils in Saudi Arabia.

The IFC's Performance Standard No 3, 'Pollution Prevention and Abatement' outlines the project approach to pollution prevention and abatement. This standard requires that during construction, commissioning and operation, the project should consider ambient conditions and apply pollution prevention and control technologies and practices (techniques) that are best suited to avoid or, where avoidance is not feasible, minimize or reduce adverse impacts on human health and the environment while remaining technically and financially feasible and cost-effective. Broad recommendations have been provided in the standard and these are summarized in the Mitigation Measures section.

The World Bank's PPAH (1998) recommendations for waste stabilization to prevent leachates of toxic metals and organics are applicable to the project. The specific recommendations are summarized in the Mitigation Measures section below.

9.4 Impact Assessment

Environmental concerns from the construction phase of the AR-SIPVPP Project include:

- Soil erosion from site preparation, excavation, earth filling and other activities
- Soil compaction
- Alteration of natural drainage from grading, leveling, excavation and other activities
- Potential soil contamination from any fuel oil and/or chemical spills, and other spills
- Alteration of shoreline soil profile from excavations of shoreline area for the AR-SIPVPP development area
- Shoreline erosion from construction of AR-SIPVPP structures
- Movement of Silt from construction of AR-SIPVPP structures

Environmental concerns from the operational phase of the AR-SIPVPP Project include:

- Soil contamination from accidental oil, chemical, and other spills and from handling of hazardous and nonhazardous wastes
- Soil contamination from accidental sewage/wastewater treatment system discharges
- Shoreline soil contamination from any accidental oil, fuel or other spills.
- Soil contamination from discharge of effluent not meeting regulatory standards.

Flood risks

The history of flood events reveals that there were no flood events in the proposed AR-SIPVPP area. However, ACWA Power Consortium/ the EPC contractor has to prepare a Flood Risk



Assessment Study /Storm Water Management plan before the construction works and implement it during Construction and Operation.

Construction Phase Impact Assessment

The construction phase will involve significant civil works required for the construction of the new plant, storage facilities for liquid fuels and pipelines, disposal facilities electrical special facilities, and all other building and infrastructure vital to service the AR-SIPVPP Project. The site preparation activities will involve clearing, backfilling with Compaction/consolidation, grading, leveling earth marking, and infrastructure and construction facilities.

The civil work scope will include ground work for foundations and general site works. The general site works will include Foundation /Piling /Drilling, leveling, grading, and landscaping where required. The foundation types for the AR-SIPVPP is planned as deep foundation (piles) while foundations for auxiliary facilities are planned as shallow foundations following proper soil improvement works. Foundations will be of reinforced concrete.

The construction of roads within the project area will involve sub-grade earthworks and any required foundations and structures works. The roads will be constructed with adequate width and strength with sub-grade earthworks for roads being compacted to 95% maximum dry density for the top 600 mm.

Trenching activities will be carried out for drainage systems such as storm water drains, sewage water drainage and treatment, process water collection and treatment, and oil water drainage.

All project excavation activities for foundations, trenches, etc. will be carried out using hydraulic backhoe excavators while excavated material will be stock piled at a specific location far away from the sensitive habitat protected by double layered silt curtains to avoid sediment dispersion. After laying the intake and outfall pipes the suitable excavation material will be reused as backfill. The surplus dredged material will be dumped at a specific NCEC approved location.

Changes to Natural Topography (Demolition, Refurbishment)

Site preparation activities will result in the removal of sediment at AR-SIPVPP from site clearing, excavation, grading, leveling, excavating, Sea bed trenching, and other activities. This will alter the existing sub-surface soil profile and affect the natural drainage contours in the area. Vehicular movement in the project areas coupled with removal of topsoil will render the soils more susceptible to erosion by winds.

However, as construction activities will be confined to the project areas only, the changes to the soil profile will essentially be confined to the site only.

Soil Erosion



Soil erosion is likely in areas where topsoil has been removed (excavated areas) and in areas where the natural profile has been disturbed as a result of construction activities, and has not stabilized. Soil erosion will be further enhanced from vehicular movement coupled with wind action in the project corridors. As a result of the overall changes in topography some erosion could occur in the immediate vicinity of the AR-SIPVPP Project.

However, since a significant portion of the AR-SIPVPP Project site is comprised of hard coral, soil erosion is not significant.

Soil Compaction

Soil compaction will mainly be due to compaction, consolidation, grading, leveling, and landscaping activities, and from foundation works for the project. Additionally, other activities such as compaction for road preparation including sub-grade earth works is expected to result in compaction of soils in the AR-SIPVPP Project areas.

Soil Contamination (from oil/chemical spills)

Soil contamination could occur from any accidental spills or leaks of oil, chemicals and other harmful liquids during the construction phase of the project. Minor oil leaks are expected from construction equipment and vehicular movement at the project site. Sufficient control measures are expected to be provided to prevent and contain any construction phase spills or leaks. Significance of any impact on soils from release of chemicals and other hazardous substance would depend on the nature and extent of the release.

Other concerns include soil contamination from spills or leaks from the chemical storage and handling facility and the fuel oil handling and storage facility.

However, the design of the chemical storage facility includes provisions for separate bunded area for each tank, capable of retaining contents of a full tank and includes drain valve assemblies and concentrated chemical receptacles for safe collection and disposal of concentrated chemicals. The bunded areas will be suitably tiled and finished internally to withstand the effects of concentrated chemicals and heat evolved from neutralization of any spillage. The floor of the bunded areas will lead to a 1 m² by 0.5 m deep tiled sump to facilitate disposal of small spillages. The tank filling collection areas of the chemical storage facility will have a trowel led chemical resistant lining with flushing and drain facilities to prevent small spillages during filling. Considering the design features to be incorporated into the chemical and fuel oil storage and handling facilities, soil contamination from spills and leaks may not be of significance (depending on the extent and nature of the spill or leak).

Cumulative Impacts



The development of the AR-SIPVPP area will slightly change the natural topography at AR-SIPVPP site. Issues such as soil compaction, potential contamination, and changes in drainage contours, modified shorelines and others are also relevant to the projects, associated facilities, nearby AR-SIPVPP Project

These impacts are inevitable in the transformation of the area for the betterment of infrastructure of AR-SIPVPP. However appropriate mitigation measures in the construction and operational phase shall ensure impacts are localized and restricted to the AR-SIPVPP area.

Article 13 of NCEC's environmental regulations requires measures to be implemented during construction, commissioning and operational phases that would prevent soil and groundwater contamination. Fines and penalties have been stipulated for inadequate safety provisions around excavated areas.

The IFC's Performance Standard No 3, 'Pollution Prevention and Abatement' outlines the project approach to pollution prevention and abatement. This standard requires that during construction, commissioning and operation the project should consider ambient conditions such as surface & groundwater, air and soil.

Impact Assessment

The environmental concerns during the construction phase are as follows:

- Alteration of natural drainage from grading, leveling, excavation and other activities.
- Creation of preferential flow paths due to piling.
- Concrete contamination of the surrounding ground and groundwater.
- Potential groundwater contamination from spills or leachates in storage area of any crude or fuel oil.
- Groundwater dewatering and discharge to neighbor environment.
- Groundwater contamination from leachates of hazardous material stockpiles.

The environmental concerns during the operations phase are as follows:

None: There will be no activities once the plant construction is over and the pipelines are installed for AR-SIPVPP.

Saudi Arabia is rapidly growing country, in recent years many areas are witnessed with much increase in construction activities. Therefore, it is important that structures such as telecommunication, airports and harbors, hospitals, schools and utility and other services should remain largely undamaged in the event of an earthquake shock. The assessment of seismic hazard involves in collecting and evaluating a wide range of data pertaining to the history and occurrence of earthquakes in a region and to their origin. Seismic zoning map and other basic data are required for the development of standard code for seismic design of structures.



The seismic zoning map for the Saudi Arabia is shown in Figure 9.6. The map indicates that the proposed project site lies within seismic zone 1.

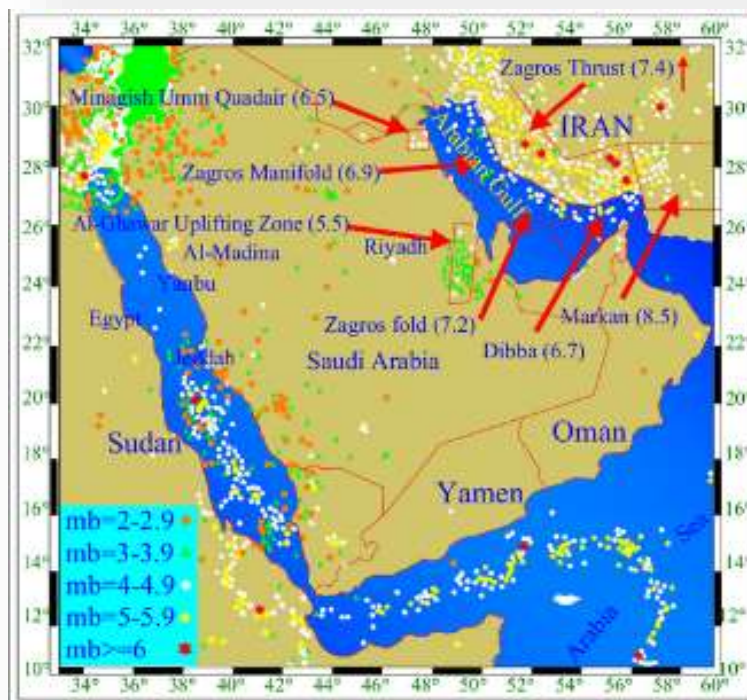


Figure 9.6 Seismic source zones affecting the eastern province of Saudi Arabia (after Fnais 2011)

9.5 Mitigation

Recommended Mitigation measures to mitigate impacts of construction and operation of the AR-SIPVPP Project on Soils and Geology of Project area

The main mitigation measure to prevent adverse effects on soils and geology, during all phases of the Project is to ensure good site practice and management. As stated in the CESMP a range of standard site management and construction methodology techniques have been identified and committed to minimize the risk to construction workers, degradation of soil quality and pollution of uncontaminated strata. The CESMP document also includes details of how excavated soils and construction generated wastes would be managed to minimize effects on soils and geology.

Following mitigation measures are recommended to address the potential impacts to soils identified in this section. Implement the spill response measures.

- Water used for dust suppression during earthworks should meet municipal health and NCEC standards and should not exceed the salinity levels of the groundwater on site;
- Dewatering should be done following the standards dewatering procedures



- The use of water for dust suppression should be controlled to ensure that the amounts applied to internal roads and tracks do not exceed the amounts required, and consequently cause excessive runoff and erosion;
- Progressively compact (stabilize) the ground to minimize the erosion of unconsolidated and non-vegetated material;
- Undertake vehicle maintenance and refueling on covered, impermeable surfaces (such as concrete slabs) with runoff to be captured in lined drains and sumps and collected material taken to appropriate waste management facilities;
- Store fuels, oils and chemicals in concrete lined and bunded areas, which are designed to contain 110% of the total volume the bunded area is designed to store;
- All construction and maintenance vehicles should be washed down or driven over shakers to remove any contaminated Soil /Sediment prior to coming onto the proposed AR-SIPVPP Project site;
- Develop and implement an erosion and sediment control plan that:
 - Restricts vehicles to driving on defined internal roads and tracks;
- Coordinates excavation work to minimize the area of disturbed and unconsolidated soil;
- Incorporates measures to manage surface runoff due to rainfall, site maintenance activities, or vehicle and hardstand wash down;
- Proper storm water and drainage system should be implemented. Incorporates the formal drainage system developed for the site; and
- No wastes should be disposed of on site, and should be managed as discussed in this section

General Mitigation Measures

General mitigation measures that are relevant to potential construction effects on soil and geology are summarized below in Table 9-1.

Table 9-1 General Mitigation Measures Relevant to Soil and Geology

Description	Benefit
Management Plan	
Impacts on soil resources during the Construction Phase will be managed and minimized through an environmental management plan (EMP). The EMP will also follow the 'rules for implementation' that will include, precautions, measures, methods and environmental standards as per GERRI (2001). The EMP will also comprise a routine maintenance program as per IFC (2007a).	Reduces the overall risk from the contaminants generated by the Project impacting the soils and geology.
Health and Safety on site	



Contractors will prepare and implement a Construction Phase safety, health and environment (SHE) Plan for each element of the Project.	Prevention or reduction of potential risks to human health from ground contamination.
Staff, site visitors and delivery drivers will receive a Project induction from the contractors to ensure they are aware of site specific hazards and health, safety and environmental management requirements.	Reduces the potential risks to human health from ground contamination.
Site staff will be briefed daily by the contractors prior to work commencing.	Reduces the potential risks to human health, soils and geology from ground contamination.
Site-specific risk assessments will be carried out to ensure the risk strategy of the frequently changing workplace remains relevant.	Reduces the potential risks to human health, soils and geology from ground contamination.
Construction Site Layout and Good Housekeeping	
Site accesses, accesses to construction compounds and roads in the vicinity of site access points will be maintained and kept clean as required.	Reduces the potential risk of contaminated soils moving off site uncontrolled
Welfare	
On-site welfare facilities will be provided for all site workers and visitors. Welfare facilities will be kept clean and tidy. All toilets will be serviced and kept clean.	Prevention and reduction of the potential risks to human health from ground contamination
Waste Management	
Waste management to be undertaken as outlined in NCEC (2017): • In line with the KSA National Integrated Waste Management part of the KSA National Transformation Program. • In line with the environmental performance index regarding air quality, protection of land and species. • In line with the Municipal Solid Waste Management Law and Regulation (see NCEC, 2017).	Reduces the risk related to the handling of waste materials and reduces the risk of contaminants impacting the soil/ geology.
Waste management planning will include characterization of waste; review of waste sources; establishment of priorities based on risk analysis; establishment of protocols for waste transport; definition of opportunities for source reduction, as well as reuse and recycling.	Reduces the risk related to the handling of waste and reduces the risk of contaminants impacting the soil and geology.
Management of hazardous waste to be undertaken as per the existing Hazardous Waste Control Rules and Procedures. The production, transportation, storage, recycling, treatment and final disposal of hazardous material must follow the 'rules of implementation' (GERRI, 2001).	Reduces the risk related to the handling of waste materials and reduces the risk of contaminants impacting the soil, geology and/or human health.
The safe work management plans (SWMPs), will be submitted to and approved by, the relevant planning authority or other relevant statutory bodies prior to construction of the Project.	Reduces the risk related to the handling of waste and reduces the risk of contaminants impacting the soil and geology.



Waste management activities on site will be managed by a nominated technically competent manager.	Reduces the risk related to the handling of waste and reduces the risk of contaminants impacting the soil and geology.
Waste materials will be treated where applicable and disposed of in a suitable manner. All measures should be taken to avoid potential impacts to human health and the environment.	Reduces the risk related to the handling of waste materials and reduces the risk of contaminants impacting the soil, geology and / or human health.
Activities associated with the management of hazardous and non-hazardous waste will be monitored, including quantities of waste generated.	Reduces the risk related to the handling of waste materials and reduces the risk of contaminants impacting the soil, geology and / or human health.
All waste disposal contractors carrying waste will be licensed to do so and all sites that receive the waste will be licensed to do so.	Reduces the risk related to the handling of waste and reduces the risk of contaminants impacting the soil and geology.
Disposal of all waste will be accompanied by the relevant transfer documentation which is required to adequately describe the waste.	Reduces the risk related to the handling of waste and reduces the risk of contaminants impacting the soil and geology.
Air Emissions	
Handling and transfer of soil and dusty material will be controlled to minimize dust generation and handling operations to be kept to a minimum. A water bowser will be used to damp down, where there are visible dust issues. Saline water from the sea may be utilized within the water bowser.	Reduces potential risk of ground contaminants migrating within and off-site.
Where there is an option, stockpiles will be located as far away from sensitive human and ecological receptors as possible.	Reduces potential risk of ground contaminants migrating to human health receptors.
Vehicle loads will be sheeted during the transportation of loose or potentially dusty or contaminated material or spoil.	Reduces potential risk of ground contaminants migrating to human health receptors.
Appropriate speed limit will be enforced on site to minimize dust generation.	Reduces potential risk of ground contaminants migrating to human health receptors.
Hard surfacing will be provided at access and egress points to the public highway.	Reduces potential risk of ground contaminants migrating to human health receptors.
Mechanical road sweepers will be used on public roads at road crossings, construction compounds and other works accesses to keep roads clear of tracked out mud.	Reduces potential risk of ground contaminants migrating to human health receptors.
Pollution Control	
Pollution prevention measures to be adopted in general accordance with the GERRI (2001) and IFC (2007a) regulations.	Reduces the risk related to the handling of waste and reduces the risk of contaminants impacting the soil, geology and human health.
Best and most suitable technologies available for the local environment and use materials that cause the least contamination to the environment (GERRI, 2001).	Reduces the risk related to the handling of waste and reduces the risk of contaminants impacting the soil and geology.
Fuels and oils at the construction compounds, on site and at work areas will be managed in accordance with the Environmental Health and Safety (EHS) guidelines developed by the World	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.



Bank Group and the IFC (2007a) and GERRI (2001).	
Fuel will be stored within secure bunded fuel tanks with an impermeable bund capacity of 110% of the tank volume.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Chemicals will be stored in accordance with GERRI (2001) and the Control of Substances Hazardous to Health Regulations i.e. in a secure Store including an impermeable storage area with secondary containment for spill management.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Fuel and chemical storage to be located a minimum of 10 m away from any watercourse. No refueling of mobile plant shall be undertaken within 10 m of a watercourse. Stockpiles at construction compounds and construction areas will be located at least 8m away from watercourses and water bodies.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Spillage kits containing suitable quantities of pollution control equipment such as sorbent pads, sorbent granules, booms or similar material to be readily available at the temporary construction compounds, on site and at work areas at all times and to be regularly checked and replaced after an event. Staff will be trained in their use.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
'Emergency Grab Packs' or spill kits to be carried in site vehicles and mobile plant and larger kits with fuel bowsers and emergency vehicles.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Emergency communications (mobile phones or radios) to be carried by relevant personnel.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
All plant and equipment to be inspected before use on site and maintenance and servicing record will be kept and checked.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
All static plant, such as pumps and generators, to have integral drip trays (be self-bunded) where possible or, as a second preference, external drip trays, which are to be checked daily.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Mobile plant to be maintained in good working order. Larger items of plant, such as excavators to undergo daily recorded inspections by a competent person (usually the operator) for any defects such as leaking hoses. Where defects are evident the item of plant shall be removed from site immediately and serviced or replaced as soon as possible.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Where vehicle wash facilities are provided, no chemicals or grit will be used and silt traps/oil interceptors will be installed.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Appropriate method statements will be in place prior to undertaking maintenance of vehicles, and	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.



maintenance will only be allowed at designated areas in the temporary construction compounds.	
For operations using concrete, grout and other cement-based products, mixing of concrete and designated contained concrete washout areas are to be located at least 10 m from any watercourse or surface water drain to minimize the risk from pollution. However, batching will be undertaken in construction compounds.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Environmental Emergency and Contingency Procedures (a Pollution Incident Control Plan) will be produced in accordance with the GERRI (2001) regulations.	Prevention of spillages of fuels, oils and contaminants limiting potential to impact soils, geology and human health.
Tools and plant to be washed out and cleaned in designated areas within the construction compounds where runoff can be isolated for treatment before discharge to a sea	Prevention of impact from contaminants on groundwater and surface water courses.
Where applicable, over-pumping will be carefully managed to prevent suspension of sediment or contamination.	Prevention of impact from contaminants, including suspended solids, on groundwater and surface watercourses.
Discharges to watercourses will be carried out in accordance with the GERRI (2001) document and IFC (2012a,b).	Prevention of impact from contaminants on surface water courses.
A surface water management plan would be developed for the construction activities in inland locations. This would specify measures to control discharges from temporary dewatering.	Prevention of impact and reduction of potential risks from contaminants to soil (potential for aggressive soil).
Drainage Management	
Pollution prevention measures will be employed such as interceptors, packaged water treatment works for waste water, provision for water treatment measures for treating suspended solids should particle sizes be too small for gravity settlement to be effective.	Prevention of impact from contaminants on groundwater and surface water courses.
Post-construction reinstatement	
Any land temporarily used for the construction of the Project will be fully reinstated.	Prevention of long-term impacts on soils and geology.
Reinstatement will include making good damage or disturbance to any soil structure, native or ornamental planting, grass, fencing, hard landscaping or structures, where in-situ reinstatement is possible.	Prevention of long-term impacts on soils.
Soil Quality / Management	
Construction work will be managed to include the safe storage and transportation of material (soil) and reused, be treated and disposed of appropriately. (GERRI, 2001).	Prevention of deterioration in soil quality.
Contaminated Land	
Contaminated land assessment measures will be adopted in general in accordance with the IFC (2007a) guidelines.	Prevention of long-term impacts on soils and geology.
Requirement for Remediation	



Where a need for remediation measures has been identified, a remediation options appraisal shall be completed in general accordance with appropriate guidance such as LCRM, Land Contamination Risk Management (Environment Agency 2019) or USEPA standards.

Prevention of long-term impacts on soils and geology.

9.6 Conclusions

This chapter has assessed the potential effects of the Project on the soils and geological characteristics within the study area. The potential for effects of contaminative soils and geology on human health has also been considered. Significance of both the soils and geology are considered to be negligible as they are both only of local importance and are not supporting designated sites or habitats. Mitigation of these effects would mainly consist of good site practice and management through measures committed to in the CESMP.



SECTION 10.0 LANDSCAPE AND VISUAL



SECTION 10.0 LANDSCAPE AND VISUAL

10.1 Introduction

The objective of the Landscape and Visual Impact Assessment (LVIA) chapter is to assess the potential key effects on the landscape and visual resource of the area and establish the overall significance of these effects arising from the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), construction works (the Project).

10.2 Legislative Framework

There is no national standard specific to LVIA. However, the following International Finance Corporation (IFC) Performance Standards are relevant to the LVIA and collective mitigation measures for biodiversity and landscape.

- Performance Standard 3: Resource Efficiency and Pollution Prevention (2012) which considers that the term ‘pollution’ includes potential visual impacts, including light; and
- Performance standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2012) considers project-related impacts across the potentially affected landscape or seascape. The landscape and visual assessment will be carried out in accordance with the following best practice guidance documents:
- The Landscape Institute and Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment (GLVIA), Third Edition; and

10.3 Spatial and Temporal Boundaries

The Study Area to be considered for the landscape and visual assessment incorporates all components of the Project along with the immediate context from which the AR-SIPVPP -CW and facilities may be visible and/or have a bearing on the landscape and visual receptors. The extent of the Study Areas for each of the three development areas are shown on Figure 17-1

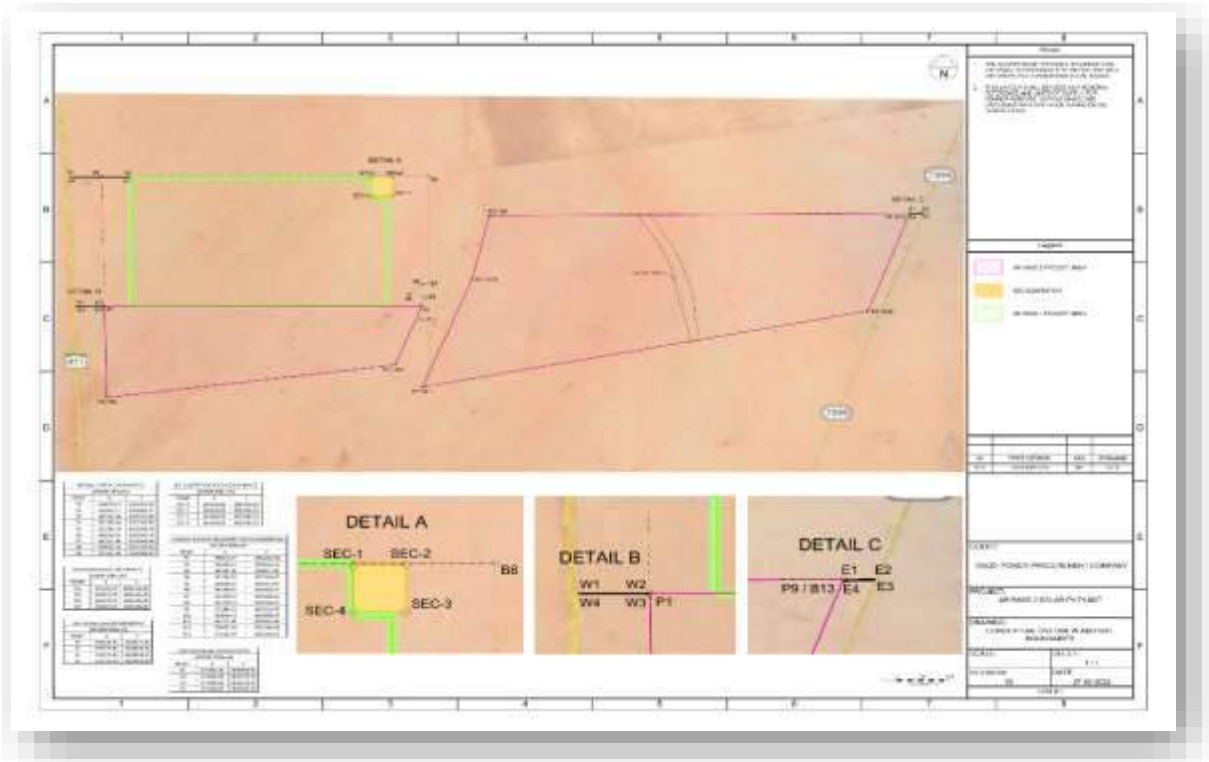


Figure 10.1: The area of Influence in AR-SIPVPP Construction works

10.3 Baseline Methodology

10.3.1 Introduction

The following section provides an overview of process and methodology undertaken to establish the landscape and visual baseline. It initially sets out the findings of the data gap analysis, followed by an overview of method for establishing the baseline and any assumptions and limitations.

10.3.2 Data Gap Analysis

There are currently no published Landscape Character Assessments for KSA and, therefore, for the purpose of this Project, and in the absence of existing specific datasets, GIS, mapping and site survey analysis have been used to define and illustrate landscape character. Landscape character mapping is a process which spatially defines the distinguishable landscape units and informs the understanding of key characteristics, sense of place and special qualities and key views. This process informs judgments on potential impacts, embedded mitigation and provides a basis to monitor future change.

10.4 Baseline Characteristics

This section provides a description of the baseline landscape character for the Project area. The landscape has been divided into a series of distinct Landscape Character Areas (LCA) based on desk-top data analysis followed by verification and refinement in the field.



This LCA is found at the Ar Rass area and covers the AR-SIPVPP area , including much of the development extent of the AR-SIPVPP site and the area to the north ,south and east. Key characteristics of this landscape include:

- The Cranes, Structures, D S Plants, Buildings
- Storage Yards
- Vehicle Parking Areas
- Storage Yards
- Ware Houses
- Site offices
- Landscaping
- Vehicles
- R O Plant
- Various buildings
- Infra structure of AR-SIPVPP



Figure 10.2 General View of AR-SIPVPP project site



Figure 10.3: View from East



Figure 10.3: View from South



Figure 10.4: View from West

10.5 Visual Amenity

In order for there to be visual effects there is the need for a receptor/ viewer (i.e., a person). Receptors tend to include residential/ tourist properties, recreational facilities, road users, pedestrians and other outdoor sites used by the public. Desk and field-based survey has indicated that formal settlement and recreational facilities are not available and limited within, or in close proximity to, the Project. Potential visual receptors are therefore largely limited to users of main Road to the site; the exception of a small number of residential receptors.

10.6 Impact Assessment and Mitigation

The following provides details of the impact assessment methodology for the LVIA which builds on the ESIA wide significance criteria, tailoring it to the specific requirements of landscape and visual. The LVIA is undertaken in the following four key stages:

- Baseline data collection and description;
- Assessment of sensitivity of landscape and visual receptors;
- Assessment of the magnitude of change; and
- Assessment of impact significance.

Assessment of Sensitivity of Landscape and Visual Receptors

The evaluation of landscape sensitivity to change involves consideration of the nature of the landscape and its ability to accommodate change without compromising its key elements or characteristics. Sensitivity to change has been defined through appraisal of landscape value and the susceptibility of the landscape to change. Landscape value is frequently addressed by reference



to international, national, regional and local designations. However, the absence of such a designation does not necessarily imply a lack of quality or value. A range of other factors are considered in determining landscape value which can render areas of nationally unremarkable quality, highly valuable as a local resource. These attributes include:

- Condition;
- Scenic quality;
- Scarcity, rarity and representativeness;
- Conservation interest or cultural and historic associations;
- Recreational value; and

10.7 Landscape Impacts from structures of AR-SIPVPP Project

The AR-SIPVPP site is a vacant area established facility within a designated water treatment facility zone. No new land is needed for construction, and all land and future worksites are vegetation free and considered brownfield sites. The landscape of the industrial zone is flat, and all buildings stand out as noticeable features on the skyline. AR-SIPVPP - with several cranes, structures, and facilities - is visible on both roads leading to the main entrance.

The visual impact of the project will be the construction equipment, structures of AR-SIPVPP Project. These changes in context, the AR-SIPVPP Project area will be a developed area and the changes associated with the AR-SIPVPP Project development will not result in change in the nature of the site. Moreover, these impacts are temporary.



SECTION 11.0 GROUND WATER



SECTION 11.0 GROUND WATER

11.1 Introduction

This hydrogeology chapter presents an assessment of the impacts of the Project on the existing groundwater conditions within the AR-SIPVPP Project Area. It includes a detailed overview of the hydro geological baseline conditions which are found within the Project Area and the surrounding area, referred to as the Study Area. Addressed in the assessment are the potential impacts associated with the AR-SIPVPP-CW. It also identifies mitigation measures required in order to remove and/or minimize potential adverse impacts to the groundwater environment. Any land use activities that might directly or indirectly impact on groundwater can lead to adverse socio-economic and environmental impact.

11.2 Scoping

The Scoping process identified the potential impacts to the groundwater conditions that could occur as a result of the AR-SIPVPP-CW. These potential impacts are summarized below. Changes in groundwater quantity or quality can have a detrimental environmental and social impact. The potential impacts on groundwater in the Project area are described in Table 11-1.

Table 11-1 Potential Impacts to the Groundwater

Project Activities	Potential Impact
Earth working areas and stockpiles	Runoff and erosion from exposed soil surface
Release of grouting and cement materials with rain wash	Groundwater contamination
Wash water from dust suppression sprays	Infiltration of contaminants leading to groundwater contamination
Maintenance of construction vehicles and mechanical equipment	Oil, fuel and lubricants may lead to groundwater contamination
Dewatering to allow construction to continue	Potential reduction in groundwater base flow (Shallow aquifer) to surface water
Oil and hazardous chemicals spill from chemical storage	Groundwater contamination
Placement of building structures	Alter groundwater flow paths by potentially modifying the discharges/recharges of groundwater area
Sewage effluent if formal municipal infrastructure will not be used	Groundwater contamination

11.3 Legislative Framework

11.3.1 National Standards/ Groundwater Water Quality Guidelines

The most comprehensive regulations addressing environmental issues in KSA is The General Environmental Regulations and Rules for Implementation (GERRI) – 28 Rajab 1422H, enacted by Royal Decree No. M/34 in 2001. The legislation sets forth a general regulatory framework for



the prevention of pollution and contamination of land, air and water resources, and provides broad implementation tactics for the management and preservation of these resources. The legislation assigns responsibility for this to the Presidency of Meteorology and Environmental Protection, now NCEC. The IFC-aligned process necessitates consideration of the national legislation but NCEC is expected to dissolve. In 2012, KSA published Standard for the sustainable management of ambient water quality by protecting the water supply and the natural aquatic environment. It provides, additionally, a basis for the restoration of water used for recreational, agricultural, industrial, potable, and ecological purposes. On 24 March 2012, the National Ambient Water Quality Standard for Saudi Arabia adopted by the Presidency of Meteorology and Environment became effective. The ambient water covered by the Standard includes underground water and any surface freshwater that may be present permanently or temporarily. The applicable legislation to groundwater quality and its purpose are shown in Table 11-2 while the guideline values are shown in Table 11-3.

Table 11-2 Applicable Legislation with Respect to Water Quality

Sector	Law / Regulation	Relation to Project
Water	National Ambient Water Quality Standard, 2012	The objective of the Ambient Water Quality Standard is to set forth national standards for the sustainable management of ambient water quality within Saudi Arabia, introducing a 'baseline standard' with which water protection can be assessed against whilst also providing a basis for the maintenance and/or restoration of ambient water quality

Table 11-3 Environmental Quality Objectives for Groundwater Quality Guidelines

Parameter	Unit	Concentration Limit	Parameter	Unit	Concentration Limit
Biological Oxygen Demand	mg/l	Not available	Benzene	mg/l	0.005
Chemical Oxygen Demand	mg/l	Not available	Carbon tetrachloride	mg/l	0.005
Total Oil & Grease	mg/l	0	Chlorinated hydrocarbons (total)	mg/l	0.001
TKN (organic)	mg/l	5	Chloroform	mg/l	NA
Total Organic Compounds	mg/l	Cyanide (free)	mg/l	0.001	
Phosphorus (total)	mg/l	0.03	Flouride	mg/l	0.2
Phosphorus (PO ₄)	mg/l	NA	Furans	mg/l	1x10 ⁻⁸
Ammonia (as NH ₃)	mg/l	0.03	Hexachlorobenzene	mg/l	0.007
Chloride (as Cl)	mg/l	NA	Lindane	mg/l	0.0002



Total inorganic nitrogen (as No ₂ & No ₃)	mg/l	30	Mirex	mg/l	1x10 ⁻⁸
Sodium	mg/l	150	MTBE	mg/l	0.02
Sulphate	mg/l	Not available	Polycyclic aromatic hydrocarbons	mg/l	0.0002
Sulphide	mg/l	0.002	Polychlorinated biphenyls	mg/l	1.9x10 ⁻⁸
Aluminium	mg/l	0.2	Pentachlorophenol	mg/l	0.0005
Arsenic	mg/l	0.005	-Aldrin	mg/l	2.2x10 ⁻⁸
Barium	mg/l	1	-Chlordane	mg/l	0.002
Cadmium	mg/l	0.005	-DDT	mg/l	1.7x10 ⁻⁸
Chromium (total)	mg/l	0.1	-Dieldrin	mg/l	4x10 ⁻⁸
Chromium (hexavalent)	mg/l	0.005	-Endrin	mg/l	0.001
Cobalt	mg/l	0.05	-Heptachlor	mg/l	0.0004
Copper	mg/l	0.05	-Toxaphene	mg/l	0.002
Iron	mg/l	0.2	Phenols	mg/l	0.005
Lead	mg/l	0.005	Dioxins	mg/l	3x10 ⁻⁸
Manganese	mg/l	0.1	Toluene	mg/l	0.002
Mercury	mg/l	0.001	Total Petroleum hydrocarbons	mg/l	0.2
Nickel	mg/l	0.02	Vinyl chlorides	mg/l	0.001
Silver	mg/l	0.1	Xylenes	mg/l	0.005
Zinc	mg/l	0.02	<i>E. coli</i>	Count / 100ml	<10

11.3.2 International Standards

11.3.2.1 IFC Performance Standards

The International Finance Corporation (IFC) Performance Standards (PSs) are directed towards project developers, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way. The standards include stakeholder engagement and disclosure obligations for the AR-SIPVPP Project. IFC PS that are applicable to groundwater resources include:

- IFC PS 1: Assessment and Management of Environmental and Social Risks and Impacts – establishes requirements for social and environmental performance management throughout the life of a project;
- IFC PS 3: Resource Efficiency and Pollution Prevention - defines an approach to pollution prevention and abatement in line with current internationally disseminated technologies and good practice. There is a requirement to address potential adverse impacts on ambient conditions such as groundwater; and



- IFC PS 4: Community Health, Safety, and Security – requires that adverse impacts on water resources in use by communities are avoided or minimized. IFC guidelines that are applicable to groundwater resources are the following:
- IFC Environmental Health and Safety (EHS) Guidelines (IFC, 2007) are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These industry sector EHS guidelines are designed to be used together with the General EHS Guidelines document, which provides guidance to users on common EHS issues potentially applicable to all industry sectors.
- The EHS Guidelines for Water and Sanitation require that the potential adverse effects of groundwater abstraction are evaluated. This is to include modelling of changes in groundwater level and consequent impacts to surface water flows. Extraction rates and locations should be modified to prevent unacceptable adverse current and future impacts, taking account of realistic future increases in demand. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever regulation is more stringent. Furthermore, the IFC Performance Standards on Environmental and Social Sustainability (IFC, 2012.) suggest that, where none exist nationally, internationally recognized standards should be used.

11.3.2.2 WHO Guidelines

The World Health Organization (WHO) has published Guidelines for Drinking Water Quality, which is kept up to date through a process of rolling revision. The most recent version of the guidelines is found in the 4th Edition, published in 2017. Tables of guideline values are presented in the 4th Edition of the Guidelines for chemicals of health significance in drinking water. Where there is no Saudi Arabian standard for a particular parameter, the WHO guideline value will be adopted.

11.5 Baseline

11.5.1 Introduction

The baseline hydro geological conditions in the AR-SIPVPP area are discussed with the main focus on the following topics:

- Geological setting of the Project Area,
- Hydro geological setting of the Project Area (groundwater, occurrence, availability, and quality)



Baseline conditions have been established through a number of primary and secondary sources. The approach and baseline information that is sourced with regard to groundwater included the following:

- The review of the existing information with respect to:
 - Geology;
 - Hydrology;
 - Topography;
 - Rainfall;

11.5.2 Ground Water Quality near AR-SIPVPP

At the time of field investigation, for AR-SIPVPP area; the results gathered from Saudi Geological survey groundwater was encountered in the boreholes at a depth ranging from 1.0 to 3.5 meters measured from the surface level. The depth of groundwater table encountered at each borehole location is presented on the individual borehole log.

Table 11.4 presents the average values and the maximum preferred limits for the Saudi Arabian Specification and Measurements, and USEPA.

Table 11.4: Ground Water Quality results

Test Parameters	Measurement		Limits	
	BH-1	BH-2	KSA	EPA
pH	8.1	7.78	(7.0-8.5)	(6.5-8.5)
E.C. (micro-Mohs)	1850	2100	(800-2300)	-
TDS (mg/L)	1100	9900	(500-1500)	500
Nitrates (NO ₃ ⁻) (mg/L)	02	04	10	10
Chloride (Cl) (mg/L)	310	510	(200-600)	250
Total Alkalinity as HCO ₃ ⁻ (mg/L)	335.5	183	400	-
Sulfate (SO ₄ ⁻) (mg/L)	180	150	400	250
Calcium (Ca ²⁺) (mg/L)	24.05	192.38	(75-200)	-
Magnesium (Mg) (mg/L)	0.09	0.13	(30-150)	-
Sodium (Na ⁺) (mg/L)	1121	1412	200	200
Potassium (K ⁺) (mg/L)	8	12	(30-100)	-
Phosphorus (P ₃ ⁺) (mg/L)	0.18	0.59	-	-
Chromium (Cr)	<.05	<.05		
Ammonia (NH ₃ -N) (mg/L)	0.2	0.2	-	-
Dissolved Oxygen (DO) (mg/L)	6.0	7.5	-	-
Total Hardness (mg/L)	70.15	83.35	500	-
Lead (Pb) (mg/L)	<.05	<.05	0.01	0.01
Cadmium (Cd) (mg/L)	<.05	<.05	0.01	0.01
Chemical Oxygen Demand (COD) (mg/L)	14	12	-	-
Fecal Coliform (No./100 ml)	-	-		
Total Bacteria (No./100 ml)	-	-		



11.6 Groundwater Availability and Use in KSA

Natural groundwater quality in KSA does not satisfy local drinking water, mainly due to natural high salinity within the superficial layers of the aquifer system. Some anthropogenic pollution does occur and the aquifer is vulnerable to pollution from agricultural practices. In this regard, possible pesticides, salinity, and nitrogen species are the most dominant pollutants affecting groundwater quality. Due to high extraction of groundwater for agricultural purposes, most water wells have been drying up. In certain parts of the country closer to the coastal areas' sea water intrusion in the fresh water (fossil water) has been observed. As a result, water quality has deteriorated with high total dissolved solids (TDS) levels measured. On a local scale, there are many ephemeral streams, which provide occasional recharge into the aquifers, however, this can be considered to be negligible due to high evaporation rate, infrequent rainfall, and exploited abstraction rates. Based on available information, in general, there is no groundwater use within the Project area that has been reported.

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 third of Saudi Arabia or 1.485 million km² (MAW, 1984). The principal aquifers are: Saq, Wajid, Tabuk, Minjur, Dhurma, Biyadh, Wasia, Dammam, Umm Er Radhuma and Neogene. The secondary aquifers are: Al-Jauf, Al-Khuff, Al-Jilh, the upper Jurassic, Sakaka, the lower Cretaceous, Aruma, Basalts and Wadi Sediments (Figure 11.1). Apart from the last two, the groundwater resources stored in these aquifers are non-renewable.

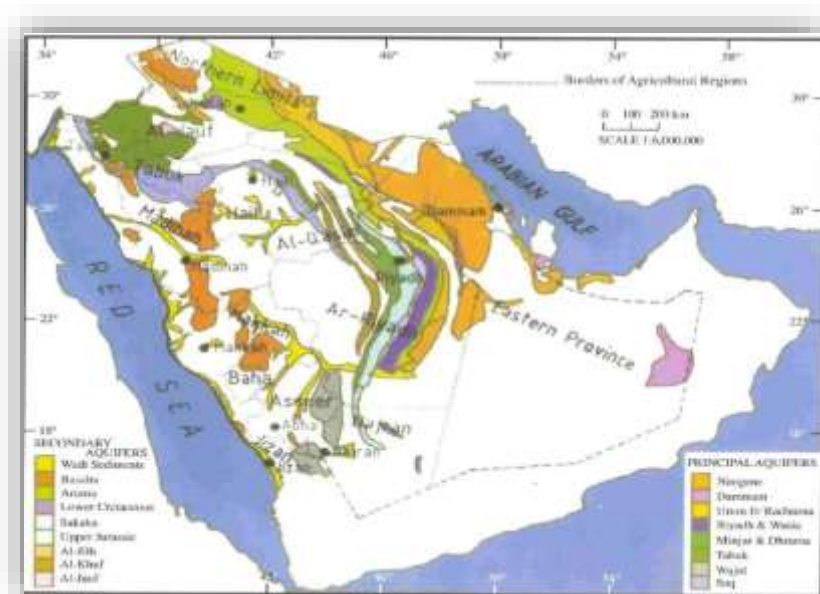


Figure 11.1: Major aquifer in KSA



Surface water	5,000-8,000 (2,230 available for use)
Groundwater resources	2,269,000 (84,000 renewable groundwater in shallow aquifers)
Groundwater recharge	3,958 (1,196 to shallow aquifers and 2,762 to deep aquifers in the Arabian Shelf)
Desalination	1,050
Treated wastewater	240

11.6.1 Groundwater Quality

Natural groundwater quality in KSA does not satisfy local drinking water standards in about 20% of the aquifer area, mainly due to natural high salinity within the superficial layers of the aquifer system. Some anthropogenic pollution does occur and it is vulnerable to pollution from agricultural practices. In this regard, possible pesticides, salinization, and nitrogen species are the most dominant pollutants affecting groundwater quality. Due to high extraction of groundwater for agricultural purposes, most water wells have been drying up. In certain parts of the country closer to the coastal areas' sea water intrusion in the fresh water (fossil water) has been observed. As a result, water quality has deteriorated with high total dissolved solids (TDS) levels measured. For the study area, there are no groundwater quality data that has been made available. Therefore, the site baseline groundwater quantity and Quality specific to AR-SIPVPP is unknown.

11.7 Impact Assessment

During Construction Phase

Groundwater may potentially be impacted during operations as a result of:

- Depletion of ground water resources and potential contamination of soil, surface and groundwater resources
- Spills or leaks of fuels, lubricants and / or chemicals from storage or maintenance areas;
- Inappropriate storage, handling or disposal of wastes substances;
- Indirect impacts from contaminated storm water and/or soils; and
- Indirect impacts from dust fallout;

Operational impacts to groundwater are likely to remain low provided sound work practices and environmental standards are adopted.

11.8 Mitigation

Mitigation measures during construction may include, as appropriate:



- Any surface water contaminated by hydrocarbons, which are used during the construction phase, to be passed through oil/grit interceptor(s) prior to collection and removal off site to an appropriate disposal site.
- Maintenance of construction machinery will not be allowed on site unless absolutely necessary to help to prevent the accidental leakage of lubricating and hydraulic fluids.
- Construction contractor to dispose of any construction effluents in a responsible manner.
- HFO storage tanks to be located on an impervious base provided with bund walls to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be contained within the bunded area.
- Portable toilets will be provided during the construction period with any waste tankered off site and disposed of in an appropriate manner.
- Refueling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.
- Spill kits will be kept on site to clean up any spills of fuels or oils. Spills would be reported and responded to as quickly as possible.
- Measures to be taken to ensure that no leachate or any surface water that has the potential to be contaminated to be allowed to enter directly or indirectly any water course, underground strata or adjoining land.
- Provisions to be made so that any existing drainage systems continue to operate.
- Disposal of excavated materials will either be off site at an appropriate landfill site or in areas of the site that will not give rise to surface run off during wet periods.
- Water inflows to excavated areas to be minimized by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.

During Operation Phase

As per scope of the work, the contractor is required by the design specification to undertake the following mitigation measures that will address water quality during operation:

- All aqueous emissions will be in compliance with NCEC and World Bank standards. This will be monitored through (a) visual inspections of the clean water drainage at least once a week for oil or grease and (b) water quality sampling of the clean water drainage once a month during operation.



- Where site roads and paved surfaces are drained, the water will pass through an oil/water separator fitted with oil detectors and automatic isolation valves. The discharge of the oil/water separator will contain no visible oil or grease.
- All buildings will be provided with roof drainage for disposal of storm water and connected to site storm water drainage system.
- Drip trays will be provided under all equipment where drips of fluids are likely to occur.
- All oil tanks will be bounded to contain 120% of the largest tank's contents. In addition, an Emergency Oil Spill Plan, outlining measures for addressing oil spills should be available at the site.

11.9 Cumulative Impact Assessment

Cumulative Impact Assessment provides an assessment of the potential cumulative effects of the Project together with other defined developments in the Project Area of Influence. This section will provide an assessment of the potential cumulative effects of the Project together with other defined developments in the AR-SIPVPP Project Area of Influence. For this Project, the main developments around the Project area include:

From the groundwater perspective, except for the AR-SIPVPP Area, no other areas have been considered for use of groundwater. The cumulative impact for the Project area of influence can be considered **Low** for groundwater abstraction (groundwater level).

11.10 Conclusions

Impact assessment criteria were developed and utilized for assessing the potential impacts on hydrogeology from the AR-SIPVPP. The assessment of potential impacts has been undertaken by identifying and evaluating a range of activities and scenarios that are likely to occur during the AR-SIPVPP-CW. In summary, the impacts are minor.

- No groundwater abstraction is anticipated in the Project area.



SECTION 12.0- TERRESTRIAL ECOLOGY



SECTION 12.0- TERRESTRIAL ECOLOGY

12.1 Introduction

This assessment considers the effects of the Project on identified ecological receptors, relative to baseline conditions associated with the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass - CW. The Project will have minor impacts on the receptors and the aim of this assessment is to focus on what the significant impacts are likely to be. This assessment goes through a process of considering potential impacts and residual impacts.

12.2 Scoping

A scoping exercise for the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass- was undertaken previously and a Scoping Report prepared in March 2023. This report described the proposed activities covered by the M/S ACWA Power Company (Saudi Listed Joint Stock Company), and some baseline information. Based on this it considered briefly what the potential impacts of the project might be on various receptors including terrestrial ecology. The scoping report then set out a proposed assessment method for terrestrial ecology and identified the scope of further data gathering and field surveys that would be required to inform the ESIA.

12.3 Legislative Framework

The assessment has been undertaken with reference to national and international standards.

12.3 National Standards

The Kingdom of Saudi Arabia has two policy documents related to biodiversity: The National Biodiversity Strategy and Action Plan (NBSAP) and the Protected Area System Plan, which together set national targets and a vision for Protected Areas in the Kingdom (2012 Saudi Wildlife Authority). The NBSAP defines the strategic goals for the protection of “*terrestrial, ecosystems by means of establishing a comprehensive system of protected areas for in-situ conservation of biodiversity*” in Saudi Arabia. The National Protected Area System Plan (NPAS) is the guiding document for Saudi Arabia to fulfill its obligations regarding *in situ* conservation under the Convention on Biological Diversity. The National Protected Area System Plan was first published in 1990 (when many protected areas were designated) and later revised in 2010. The System Plan identifies sites for protection and includes a Policy Statement that serves as the vision for the national network of Protected Areas. KSA legislation concerning biodiversity that may be applicable to the Project includes:

- The National Commission for Wildlife Conservation and Development Act (NCWCD) (1986)
- The Wildlife Protected Areas Act (1995)



- The Wild Animals and Birds Hunting Act (1999)
- Trade in Endangered Wildlife Species Act (2000)
- Environmental Code (2002)

One of the basic objectives of the NCWCD; which is now National Center for wild life (NCW) is to develop and maintain a representative system of effective protected areas in the country. The objective of the Wildlife Protected Areas Act is to conserve and develop wildlife in the Kingdom of Saudi Arabia. KSA has adopted specific topology for protected areas consisting of five categories:

- Special Natural Reserve;
- Natural Reserve;
- Biological Reserve
- Resource Use Reserve; and
- Controlled Hunting Reserve

The aim of the Wild Animals and Bird Hunting Act is to regulate hunting of wild animals and birds; and to ensure the preservation of the nation's fauna by providing opportunities for wild animals and birds to breed. Species that are protected from hunting are covered under Article 5; endangered species and migratory birds are also provided protection under the legislation. The objective of the Trade in Endangered Wildlife Species Act is of regulate the trade in wildlife and wildlife products by the system of import/export permits according to the rules of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to which KSA is a signatory. One of the provisions of the Act is for NCW to issue a list of endangered species.

12.3.1 International Standards

KSA has ratified or is a signatory to a number of treaties specifically relevant to terrestrial biodiversity presented below in Table 12-1. This is not an exhaustive list but does include those which are relevant to the Project, and in particular to Terrestrial Ecology.

KSA adopted Agenda 21 of the United Nations Division for Sustainable Development and its policies on the environment and development. Accordingly, use of the natural and environmental resources of the Kingdom has been ascertained with the purpose of satisfying requirements without tampering with the capabilities and rights of future generations.

12.3.2 International Union for the Conservation of Nature

The IUCN Red List of Threatened Species, one of the most well-known objective assessment systems for classifying the status of plants, animals, and other organisms threatened with extinction. It contains explicit criteria and categories to classify the conservation status of



individual species based on their probability of extinction. The IUCN Red List for KSA is used for the descriptions of flora and fauna within the Study Area.

12.4 Assessment Guidelines

The approach to this assessment is based on the general guidelines for ecological impact assessment (EcIA) published by the Chartered Institute of Ecology and Environmental Management (2018 CIEEM). In addition, the criteria set out by the International Finance Corporation (IFC) in Performance Standard 6 (PS6) (2012 IFC; 2019 IFC) have been specifically referred to when determining the importance of receptors, identifying natural habitat and considering mitigation, offsetting and future management.

12.5 Baseline Methodology

12.5.1 Introduction

In order to establish the baseline several linked activities have been undertaken. These have comprised a desk study to establish background information relating to the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -CW site and associated AoI, as well as field studies to confirm ground conditions at the sites and to try to establish the presence or otherwise of potential ecological receptors.

12.5.2 Natural and Critical Habitat

A CHA has been undertaken for the project, but there are no critical habitats existed in the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass vicinity.

IFC Performance Standard 6 (IFC PS6) requires that habitats that may be affected by the project, including indirect impacts and impacts associated with associated facilities, are characterized. IFC PS6 defines critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregator species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. In addition, there is a requirement to identify whether habitats are natural or modified, as both can in fact comprise Critical Habitat.

12.5.3 Terrestrial Ecology of AR-SIPVPP Project area

Habitat Types

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass plant will be located in an undeveloped area located in a vacant land surrounded by empty area.

During the survey; two types of habitats were distinguished; the Grey /Red Soil / brown with stones area.



Terrestrial Ecology of Ar Rass Solar Power Plant Project Area

Ecology of the site

Introduction

The Kingdom of Saudi Arabia cover about 1,969,000 square kilometers, presenting two thirds of the Arabian Peninsula. The Kingdom is known to have a portions of two out of the eight known global terrestrial realms; namely the Palearctic and the Afrotropical. Also located along an important flyway between Eurasia and Africa, which give an important area for the diversity of migratory birds (Shobrak 2012). The Kingdom hosts several important habitat including freshwater wetlands, isolated mountain massifs, juniper woodlands, islands, sea grass beds, mangrove thickets, coral reefs, salt marshes, algal beds, acacia woodlands, rawdahs (meadows) and Wadis (valleys). Therefore with these biological diversity and productivity, these key biological sites, or hotspots, are probably fundamental in the synergistic framework of associated ecosystems (NCWCD 2005).

Therefore, Saudi Arabia represents an area of great ecological significance. To conserve these ecosystems and wild fauna and flora connected to these biological sites, the Kingdom of Saudi Arabia presented in the Saudi Wildlife Authority (SWA) develop a national strategy to contribute to protect the biodiversity. The strategy was prepared with the aims to integrating the conservation and sustainable use of biodiversity into the national planning process with all development programs (NCWCD 2005). The Strategy has identified seventeen Strategic Goals to encompass the various sectors: three strategic goals for the ex-situ and in-situ conservation of wildlife and wild habitats; two strategic goals for the sustainable use of woodlands and rangelands; three strategic goals for the conservation and sustainable use of living natural resources; nine general strategic goals that provide direct support to biodiversity. Part of the objectives set out in the plan covered several elements such as the protection of terrestrial, ecosystems through the establishment of protected areas. One of important goals of the strategy was to conserve and manage of biodiversity of wild fauna and flora outside protected areas partly through introducing of Environmental Impact Assessments (NCWCD 2005).

According to article five (5-1) in the general role of Environmental in Saudi Arabia issued 2006 by the Presidency of Meteorology and Environment (PME) now renamed as GAMEP and again as NCEC which showed that agencies would like to develop an industrial project such as the new AR-SIPVPP they should carry out an Environmental Impact Assessment (EIA) study for the site. Therefore, it essential for these for these to determine the ecological aspects of the site and the possible effect of the activities in the environmental. However, one of the main components for the EIA study is the biodiversity occur for the selected site.



In this report, the results of the biodiversity survey for AR-SIPVPP site is presented and discussed. The main objectives of the report are; to determine the biodiversity occur (Fauna and Flora) in the site and to evaluate the possible impacts on terrestrial fauna and flora resulted from the activities of the proposed site for the project. Moreover, the basic landforms/habitat types occurring on the site will be identified.

Biodiversity of Saudi Arabia Flora

The 2250 species of flora in Saudi Arabia belong to 132 families and 837 genera. Out of these species 40 are considered endemic. However, the flora of are facing several threats such as; degradation of rangelands; uncontrolled cutting of trees and shrubs; accelerated development programs; years of periodic drought; modern agricultural practices on virgin lands and loss of agricultural terraces.

Fauna

According to NCWCD (2005) there is probably 76 species of terrestrial mammals and 22 marine mammals occur in Saudi Arabia and about 444 bird species with 10 endemic species. As the Amphibians there are Seven native amphibian species restricted to freshwater seeps and ephemeral pools. As the reptiles, there are 55 species of snakes, 70 species of lizards and five species of marine turtles with two species the green and hawksbill turtle, which they nesting in the Saudi' marine territories. As the marine fishes; there are over 1280 species of fish have been recorded in the Red Sea and 542 species in the Arabian Gulf. As the freshwater fishes there are probably nine species most of them are endemic to the region.

Despite this large number of biodiversity, the fauna of the Kingdom faces several threats such as over-grazing and wood-cutting, overhunting, overfishing, loss of terrestrial, , urban expansion and human settlements, pollution of water sources, expansion in agricultural lands, introduce of invasive species, and indiscriminate use of pesticides.

The main goals of the studying the biodiversity of Ar Rass area as a part of Environmental Impact Assessment are to determine the main important biodiversity and possible threats to the species and their habitats at site especially with present plan for Ar Rass city development for the site. Moreover, habitats occur at the site were identified and described

- Study site and Methodology
- Site Location and General Description

The site is located in the barren land located north east of Ar Rass Town

Biodiversity Survey Methodology



There is no information available on the ecology of this area, a desktop and qualitative surveys of the flora and fauna of were conducted. Photographs and observations by the Environmental Balance specialist team on the flora and fauna were taken to develop biodiversity report of the site.

During the survey we applied three methods to determine the species associated with habitats in various sites:

- Literature review.
- Random observations and quadrates

Literature review

There is limited information available derived from the previous literatures. The majority of articles and books covered the surrounding the site was reviewed such as the majority volumes of the Fauna of Saudi Arabia.

Random observations and quadrates

Due to the size of the site, and the limited time available to conduct the survey, it was necessary to drive around the site, stopping at natural vantage points. The information provided in this report is based on these rapid surveys, and describes the land use across the site. During the survey, a total of several stops was made. Landscapes were photographed as well as at the sample stops.

Fauna

A General survey for the biodiversity were carried out by the Environmental Balance team during March 2023. The habitat and all fauna species observed at the site and adjacent areas were recorded and photographed. For detailed identification of the fauna, we used along with our knowledge and expertise; direct observations during random walking and driving at the site and adjusted areas. Moreover, literature review was used to confirm the sighting from the tracks and also determine the possible species occur at the site. For identification of species, we used Harrison (1972); Harrison and Bates (1991), Nader (1990) and Saudi Aramco (2017) for mammals, while the reptiles we used Egan for snakes and Saudi Aramco (2017) and Dahlawi and Sarhan (2015) for lizards. Whereas for birds we used del Hoyo and Collar (2014; 2016), Jennings (2010), Porter and Aspenal (2010). Finally, the IUCN red list status globally and regionally was used to determine the threaten species in the site (Mallon and Budd 2011; IUCN 2018).

Flora

Using the random observations method, all species observed within the project site and adjusted areas were recorded and photographed. A list of the annual, perennial and dominant species was recorded and identified. For field Identifications we used several field identifications guides references such as; Collenette (1999), Migahid, (1978), Chaudhary (1999; 2000), and Boulos,



(1999; 2000; 2002; 2005; 2009). The **DAFOR** scale was used to determine the relative abundance of each species as following: **D** = Dominant; **A** = Abundant, **F** = Frequent, **O** = Occasional, **R** = Rare.

The current laws of Saudi Arabia provide a comprehensive framework of legislation under which the Kingdom can fully meet its obligations as a signatory to the Convention on Biological Diversity (CBD). Table below presents presented the laws in the chronological order in which they were implemented.

According to article 5-1 of the General Environmental Regulations and Rules for Implementation of Kingdom of Saudi Arabia issued 2001 by the PME/NCEC which states that the developer should conduct an EIA for any development project. However, to carry out this study it is essential to determine the ecological aspects of the site and the possible effect of the activities in the environmental of site. Thus this ecological survey has been carried out and presents the initial results of biological survey to evaluate the possible impacts on terrestrial ecology from AR-SIPVPP project site with the following objectives:

- Flora – Diversity and abundance, Classification up to generic level
- Fauna – Diversity and abundance, Classification up to generic level

Table . Legislations pertaining to Biodiversity in Saudi Arabia

Title	Date
Agricultural and Veterinary Quarantine Regulations	1975
The Uncultivated Land Act	1978
The Forests and Rangelands Act	1979
The Water Resource Conservation Act	1980
The National Commission for Wildlife Conservation and Development Act	1986
The Fishing Exploitation and Protection of Live Aquatic Resources in the Territorial Waters of Saudi Arabia Act	1987
The Wildlife Protected Areas Act	1995
The Wild Animals and Birds Hunting Act	1999
The Act on Trade in Endangered Wildlife Species and their	2000
Environmental Code	2002

Ground truthing survey is the methodology to determine and to identify any present flora and fauna within the site. Parts of the activities are to document existing life forms habitat, environmental conditions and anthropogenic activities through 100x100 m² walkover techniques. The team that conducted the survey was using GPS, camera and notebooks to record and documents all significant information around the site. Any species that the team could not identify in the field was collected as a sample for identification at the laboratory.

This terrestrial ecology survey has been undertaken from 03rd March 2023 4th March 2023 and identified flora and faunal species. The team observed few succulents/ xerophytes and shrubs,



perennials and annuals typically associated with flat terrain, and AR-SIPVPP habitat. The project site is totally underdeveloped with dead remains of Camels, Sheep's, and Goats. Few grazing animals found in the surrounding areas.

The livestock population observed during the survey.

Table . General observation report

Tasks	Observations
Surface cover site (Sandy & Stoney desert, hard standing, scrub vegetation etc. potential for surface water infiltration)	Sandy flat /Terrain desert with vegetation composed of scrubs, creepers, and Succulents
Building and hard standing materials	None. The site is a barren land with Solid waste dumped at many places
Visible evidence of contamination (looked for vegetation dieback, discolored liquid)	➤ Used tires ➤ Building demolition waste ➤ Plastics ➤ Mixed Garbage ➤ Wooden materials ➤ Used furniture
Waste disposal	Many heaps of solid waste dumped in the AR-SIPVPP site
Presence of vegetation and invasive weeds	➤ Shrubs ➤ Xerophytes ➤ Bushes Comprising less than 5% of the total area
Presence of wildlife	A wild Fox, was observed during site visit
Livestock	Camels, Goats, sheep, Horses, Donkeys
Buildings/built structures on site • Presence of asbestos	None
Presence of station/transformers) PCBs (electrical sub stations)	None
Storage of materials/storage tanks	None
Atmospheric emissions	None
Services-overhead or buried services (overhead wires, sewers, effluent discharges, gas main, petrol interceptors, where do drain discharge to?) Are any surface water drains in sensitive	None
Site geology (surface outcrops/exposures of soils/rocks in any areas of excavations, drainage ditches, cutting etc.	
Site topography	Sandy & gravel terrain
Surface water bodies and courses	
Distance to nearest properties	4 Km
Observation on neighboring site	Barren land



The flora at the AR-SIPVPP site is very sparse. Estimated less than 5% of vegetation in the overall area of the project site, that mostly composed with grass and shrubs, with no trees were observed during the survey.

There were no evidences of Bedouin population found at AR-SIPVPP site. Solid waste heaps, borrow pits were observed. During the ecological survey, some sheep and camels were found to be foraging in the surrounding sites.

The survey team could find any animals during the survey.

The majority of the project site has been disturbed by the human activities, land filling and most of surrounding areas were partly covered by solid waste. However, three types of habitats were distinguished; sandy hummocks, open sandy gravel.

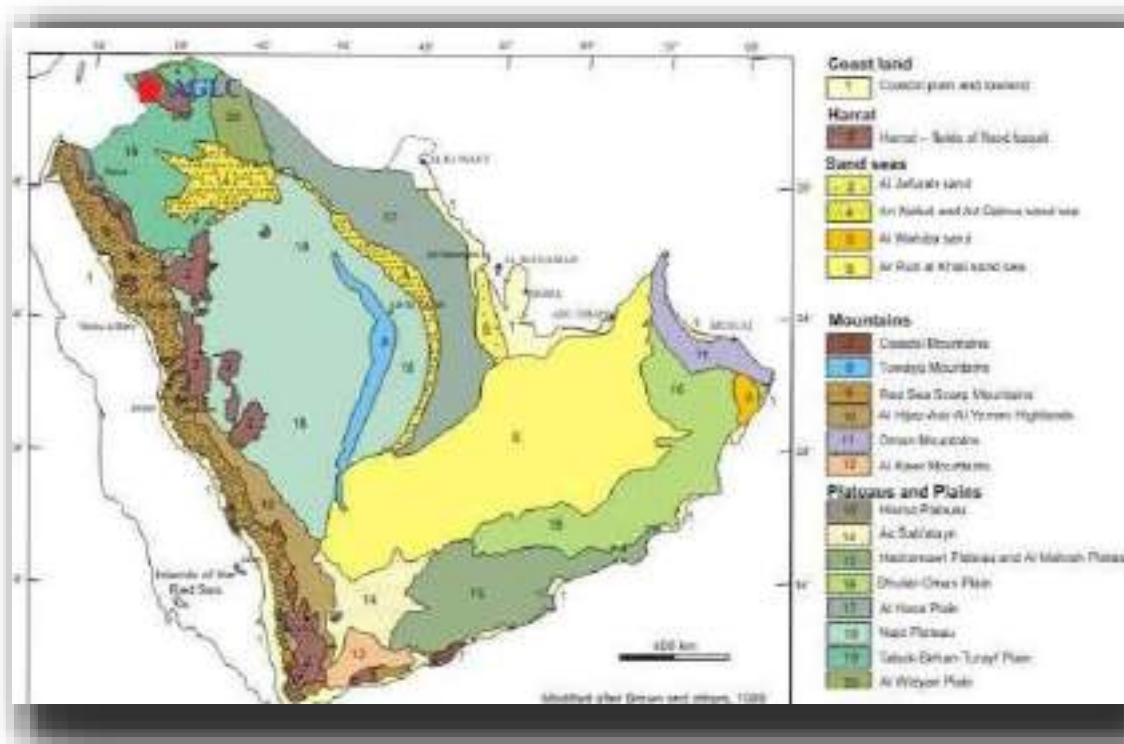


Figure: Soil Types near AR-SIPVPP

Terrestrial Ecology of Ar Rass Solar Power Plant Project Area

The Study Area is characterized by its sparse, patchy dwarf shrub vegetation, concentrated in small drainage lines, wadis and silty depressions. There are no trees, except for the occasional *Tamarix arborea* along large stream beds north of the proposed site. Dominant perennial shrub species include *Haloxylon salicornicum*, *Salsola* spp., *Artemisia* spp., *Achillea fragrantissima*, *Astragalus tristis*, *Zilla spinosa* and *Capparis spinosa* are abundant on the margins of silty depressions.



Plants:

- *Haloxylon persicum*
- *Calligonum comosum*
- *Haloxylon salicornicum*,
- *Salsola spp.*
- *Artemisia spp.*,
- *Achillea fragrantissima*,
- *Astragalus trimestris*.
- *Zilla spinosa*
- *Capparis spinosa*
- *Calotropis procera*
- *Panicum turgidum*
- *Cocculus species*
- *Cyperus Sp*
- *Acacia sp*

None of the above Plant species are listed in IUCN Red list



Figure. *Haloxylon persicum*



Figure. *Calligonum comosum*



Figure. *Haloxylon salicornicum*



Figure. *Salsola spp*

- *Achillea fragrantissima*,
- *Astragalus trimestris*.
- *Zilla spinosa*
- *Capparis spinosa*
- *Calotropis procera*
- *Panicum turgidum*
- *Cocculus species*
- *Cyperus Sp*
- *Acacia sp*

None of the above Plant species are listed in IUCN Red list



Figure . *Haloxylon persicum*



Figure. *Calligonum comosum*



Figure Haloxylon salicornicum



Figure. Salsola spp



Figure. Zillaspinosa



Figure Capparisspinosa



Figure . Panicum turgidum



Figure . Calotropis procera

Table .Fauna

SI No	Common Name	Zoological Name
1	Goat	<i>Capra aegagrushircus</i>
2	Sheep	<i>Ovisaries</i>
3	Donkey	<i>Equusasinus</i>
4	Horse	<i>Equuscaballus</i>



5	Camel	<i>Camelus</i>
6	Cat	<i>Feliscatus</i>
7	Dog	<i>Canis lupus familiaris</i>
8	Wild Fox	<i>Vulpesvulpes</i>
9	Crested lark	<i>Galeridacristata</i>
10	Palestine sunbird	<i>Cinnyrisosea</i>
11	Stonechat	<i>Saxicolarubicola</i>
12	Isabelline wheatear	<i>Oenantheisabellina</i>

The existing plant communities observed near Ar Rass Power Plant project area during Terrestrial Ecological survey. Only few shrubs were found.

Environmental Sensitivity

Management - Protected Areas



ReefGIS Online Map

Figure: Map showing protected areas in KSA

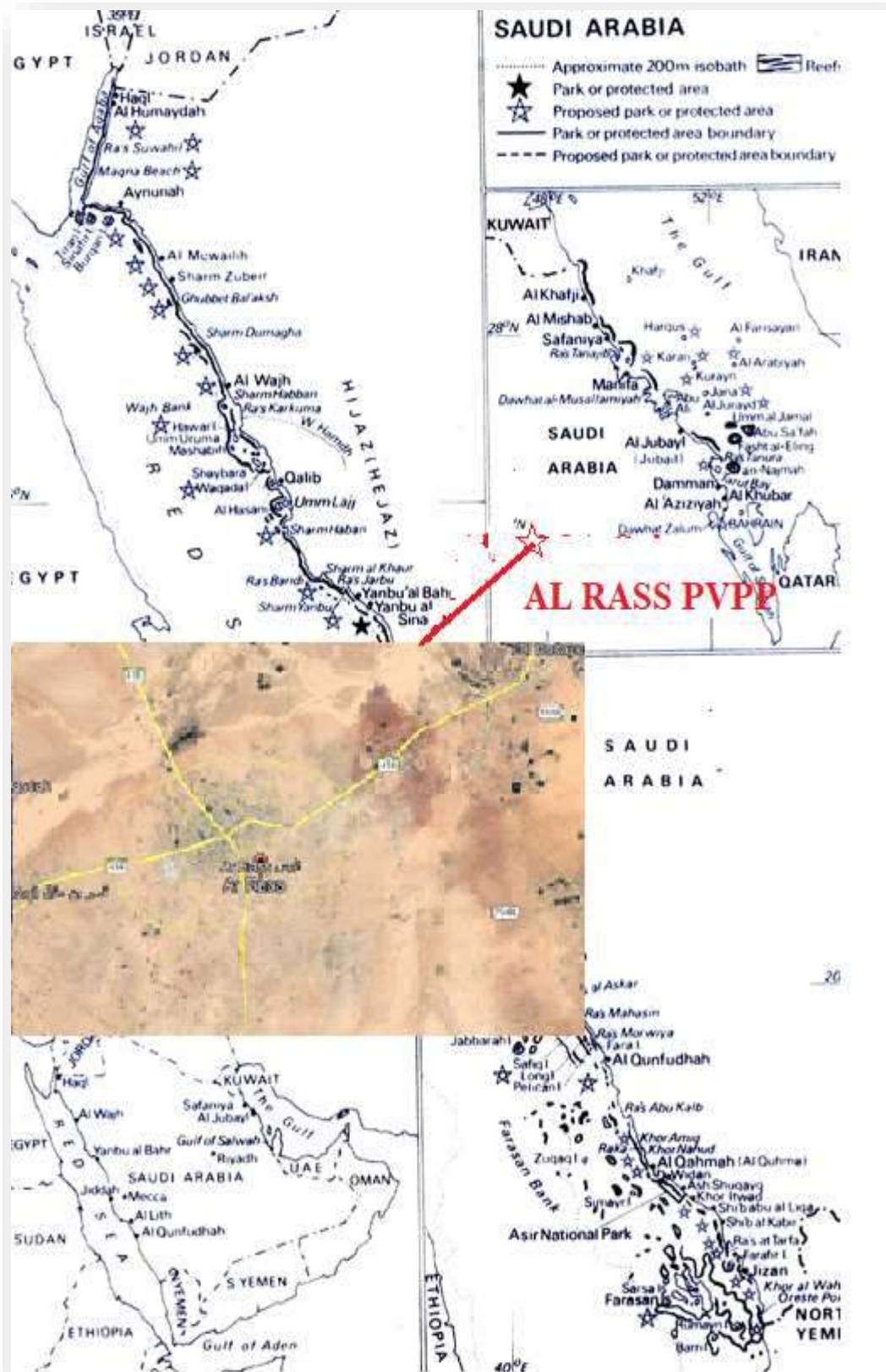
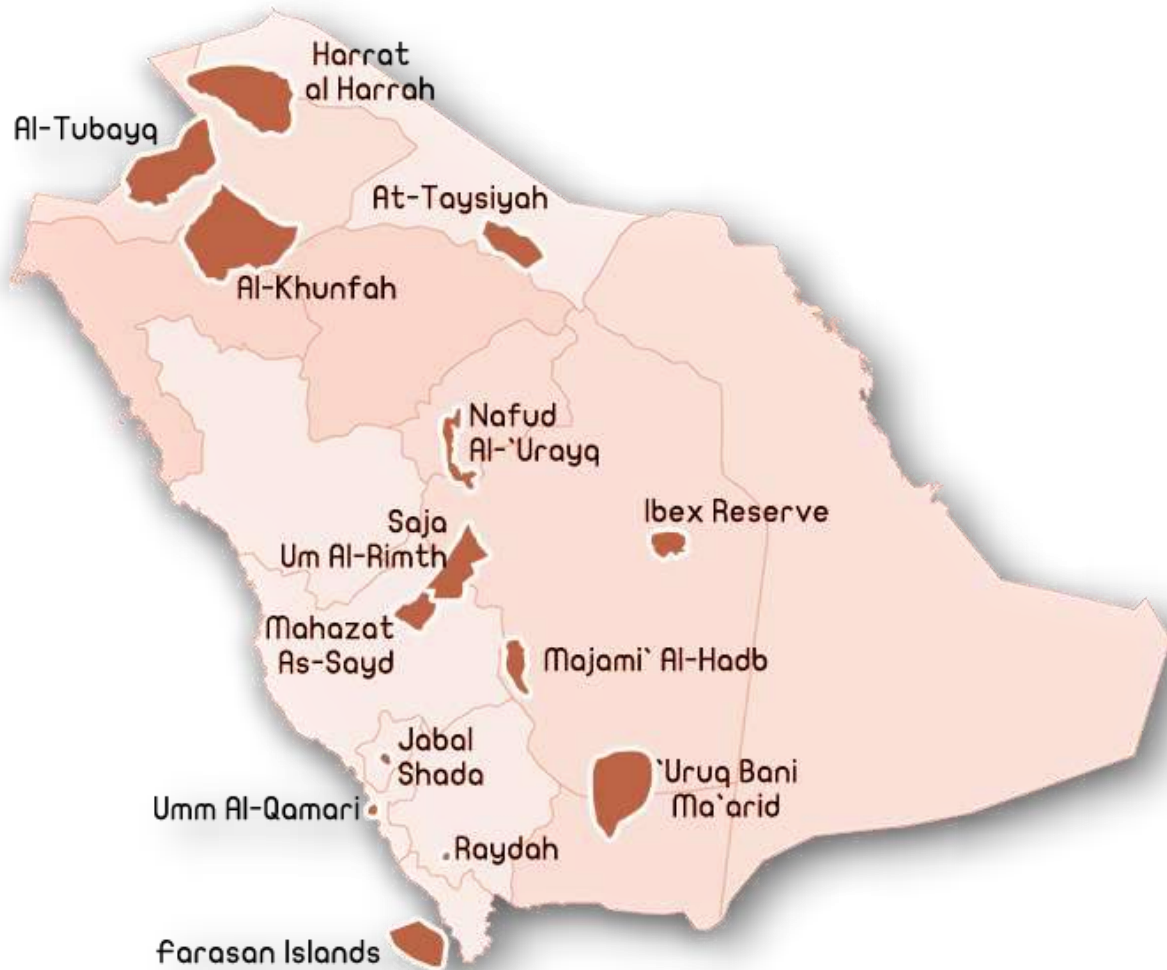


Figure: Protected areas within the Saudi Arabia



The currently existing protected areas include **15 protected areas (12 terrestrial protected areas and three marine protected areas)** with the aim of preserving a set of integrated natural ecosystems, which are: Jabal Shada, Majami al-Hadb, Jurf Raydah, 'Uruq Bani Ma'arid, Harrat al-Harrah, Al-Khunfah, Ibex Reserve, ...

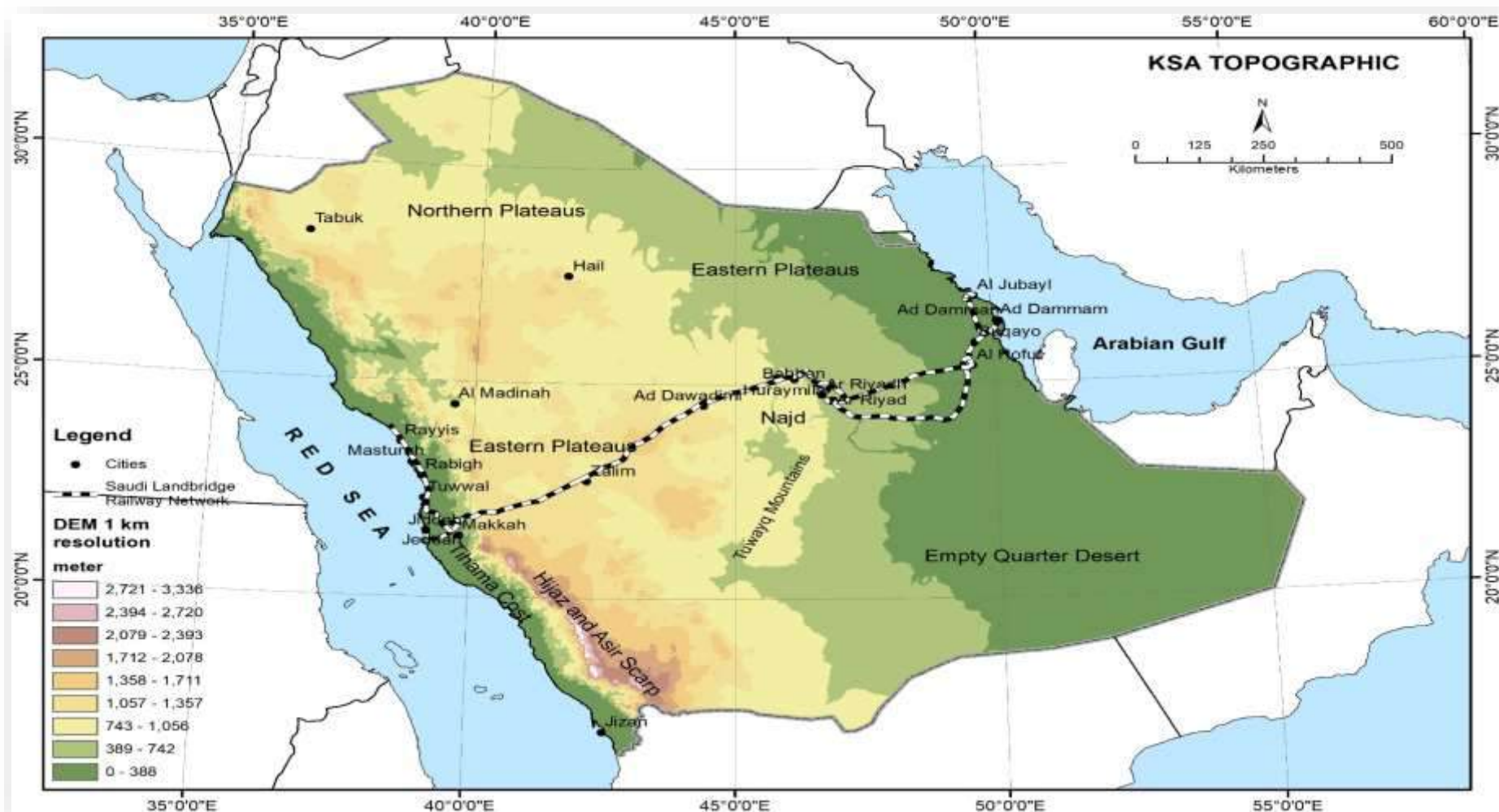


Figure: Elevations from the sea surface





12.6. Impact Assessment

The assessment of impacts has been undertaken by identifying and evaluating a range of activities and scenarios that are likely to occur throughout the phases of the Project. As the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -CW is exclusively construction works there is no assessment in this ESIA relating to operational impacts. The key activities with the potential to affect ecological receptors during each of the Project phases are included below:

- Fencing off the site
- Construction of access roads
- Establishment of workers' compound / offices areas
- Site clearance (vegetation)
- Site levelling and earthworks
- Stockpiling of soil and other materials
- Excavations and trenching (e.g., for pipes and cables)
- Vehicle movements on site and for deliveries
- Waste management and sanitary arrangement for workers
- Refueling and maintenance of site vehicles
- Fuel and chemical storage
- Temporary site drainage and spill control

Table 12-4 Impact Assessment Matrix

Receptor Importance	High Adverse	Medium Adverse	Low Adverse	Very Low Adverse
High	MAJOR	MAJOR	MODERATE	MINOR
Medium	MAJOR	MODERATE	MINOR	NEGLIGIBLE
Low	MODERATE	MINOR	NEGLIGIBLE	NEGLIGIBLE
Very Low	MINOR	NEGLIGIBLE	NEGLIGIBLE	NO IMPACT

Environmental concerns from the construction phase of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass include:

- Displacement of flora at the AR-SIPVPP Project site and shoreline areas from site preparation activities
- Loss of habitat from construction of the Plant components and associated facilities
- Exposure of flora and native fauna to dust emissions, construction wastes, hazardous materials, and fuel oil or chemical spills.

Environmental concerns from the operational phase of the AR-SIPVPP Project include:

- Exposure of flora and native fauna to contamination from fuel oil and other spills or accidents, and hazardous and other wastes.



Construction Phase Impact Assessment

Displacement of flora and Loss of Habitat

Site preparation activities for the AR-SIPVPP Project will involve clearing, excavation, and foundation for Plant, grading, leveling, earth marking, and construction of temporary roads among others. During initial site preparation activities project area there is no flora is expected to be displaced particularly around the AR-SIPVPP Project site. However, as the vegetation is too sparse and existing species are not of conservation value, displacement of flora is not a concern.

Exposure to Dust, Spills, and Wastes:

During the construction phase the ornamental/avenue flora will be exposed to dust emissions from construction activities and oil and chemical spills, and wastes. Dust generation will lead to deposition on vegetation in and around the project areas. However, vegetation in these areas is typically adapted to extreme conditions such as high summer and low winter temperatures, and sand storms, the effect of dust on flora is not expected to be significant. Faunal species such as rodents' snakes and lizards could be exposed to wastes and any spills at the site. The project is expected to ensure dedicated storage areas for waste and sufficient measures to respond to any spills or leaks.

Operational Phase Impact Assessment

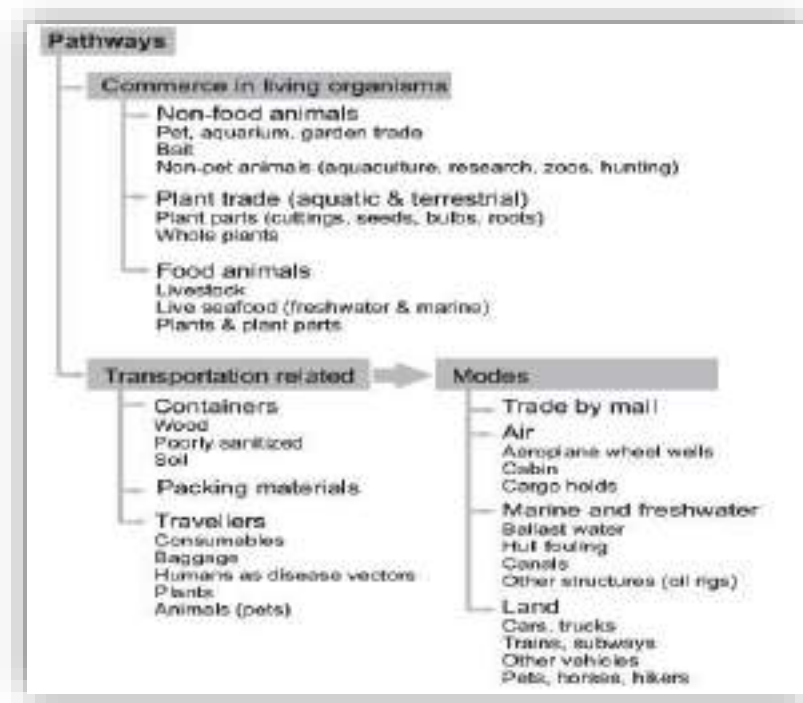
There are no major operational phase impacts expected from the proposed project on as most of the impacts would have occurred in the construction phase (displacement and loss of habitat). Therefore, the impact on vegetation from the operations phase of the proposed AR-SIPVPP project will not be significant.

Exposure to Fuel Oil and Chemical Spills:

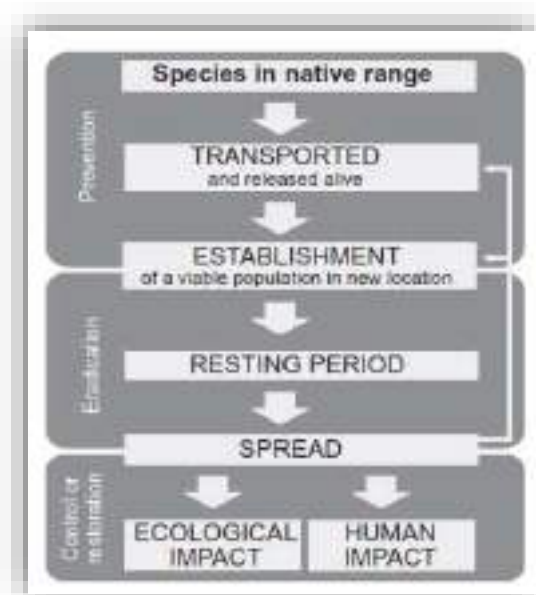
Exposure of flora to fuel oil or chemical spills is not expected to occur as the fuel oil and chemical storage facilities will have adequate design and control measures such as bunded areas, lining, and tiles to prevent and control leaks and spills.

Moreover, the AR-SIPVPP Project site (including the storage facilities and their vicinity) is expected to be devoid of vegetation as it will be cleared and graded in the construction phase itself. In the event of oil or chemical spills or leaks in areas outside the AR-SIPVPP Project site the impact on vegetation (and surrounding areas) will depend on the nature and extent of the spill event. The impact is most likely to be localized to the area of the spill affecting vegetation only within the spill diameter.

Monitoring and mitigating measures to limit the spread of invasive species



Pathways responsible for the introduction of alien species



Stages in the invasion process of a nonnative species, pointing out activities that need to be carried out at each stage

12.7 Mitigation

- All earthworks' vehicles will be washed down or driven over shakers to remove any seeds of weed species prior to coming onto the proposed AR-SIPVPP Project site;



- Disturbance of land surface should be minimized, including restricting traffic to defined access tracks and minimizing movement of vehicles and construction and maintenance plant in areas not subject to disturbance by construction activity;
- Appropriate waste storage to limit the potential proliferation of non-desirable fauna (such as rats, cockroaches and flies);
- If a threatened species is encountered on site, all nearby construction activity should cease and the EPC Contractor's Site Manager notified. No further work should continue in the vicinity of the sighting until a qualified biologist carries out a field assessment. No attempts should be made by EPC Contractor's /Sub contractor's Site personnel to capture, harm or disturb the animal/s;
- Plants those will be removed, collected and stored until disposing of them under NCEC guidelines;

Mitigation of Invasive Species

- Prevention at source and on arrival: border control and quarantine measures
- With the cooperation of regulatory authorities, the operator cooperates to strengthen and prioritize border control and quarantine measures for alien species that are or could become invasive, making best use of existing resources and information systems.

Introductions through Procurement operations

Proposed introductions are assessed through a comprehensive screening system based on risk analysis. This should make all efforts to permit only those species that are unlikely to threaten biodiversity.

Unintentional introductions

Appropriate measures and operational resources are in place to minimize unintentional introductions resulting from sectoral activities.

In-country prevention

Measures are in place to minimize the introduction, establishment and spread of invasive alien species or potential invasive alien species within a country.

Special measures for AR-SIPVPP area

Patterns of spread of established invasive alien species are better predicted to allow timely responses by neighboring areas of AR-SIPVPP.

12.8 Cumulative impacts

Major industrial facilities are planned for the Ar Rass area including the adjoining AR-SIPVPP area. The development of the region will inevitably result in habitat loss, and exposure of flora



and their habitat to emissions and discharges. However, it should be noted that the industrial cities are located outside any protected areas terrestrial habitat.

Ecological impact assessment is in sense a cumulative assessment. This is because we are dealing with biological systems that may be affected by many differing aspects of the Project and it is therefore the cumulative impact of the Project itself on those receptors that we are seeking to define. As the AR-SIPVPP site is completely developed area with sparse vegetation there is endangered vegetation existed. The fauna will not be affected as the habitat will not be affected by the AR-SIPVPP -CW. The CIs are negligible.

12.11 Conclusions

AR-SIPVPP site is completely developed area with too sparse vegetation. There is no endangered vegetation and fauna existed. The fauna will not be affected as the habitat will not be affected by the AR-SIPVPP. The recommendations of CESMP required to be implemented.



SECTION 13.0 SOCIO ECONOMIC STUDIES



SECTION 13.0 SOCIO ECONOMIC STUDIES

13.1 Introduction

This chapter presents the socio-economic assessment, the aims of which, as stated in the Terms of Reference (ToR) issued for this assessment, are to:

- Describe the socio-economic environment within which the Project activities will occur;
- Identify, describe and assess the expected significance of potential socio-economic impacts that may arise as a result of the proposed Project activities; and
- Develop appropriate mitigation measures and management actions to avoid or minimize potential negative impacts, and to enhance the positive impacts associated with the proposed AR-SIPVPP Project.

13.2 Scoping

The impact assessment builds on the Desktop based social scoping study, which was completed in October 2021. The scoping study established that AR-SIPVPP–CW will have positive socioeconomic impacts, especially considering the duration, components and objective of the proposed AR-SIPVPP–CW. This was done by compiling a list of “typical” socio-economic impacts that are routinely assessed, reviewing each of these in the light of what is known about the project activities and the respective receiving environment, and then discarding the irrelevant impacts (i.e., the ones that are likely to have no or extremely limited significance).

Table 13-1 Scoping Summary

Impact	Included in Scope	Motivation
<i>Employment creation</i>	Yes	AR-SIPVPP-CW will require a substantial labour force
<i>Contribution to the economy in nearby communities (through local procurement and multiplier effects)</i>	Yes	Significance will depend on the capital expenditure during AR-SIPVPP-CW as well as increased disposable income spent locally
<i>Negative side-effects of local economic growth (price inflation, economic dependence on the Project)</i>	No	Unlikely to occur as a result of the scale of AR-SIPVPP-CW, which will be short term and relatively limited; however, this could act on a cumulative scale together with future developments planned for the area.
<i>Macro-economic impact</i>	No	Unlikely that economic stimulus from early work activities will have a significant impact on national economy.
<i>Impacts associated with the presence of a foreign workforce</i>	Yes	This impact is likely to occur in the context of this Project, especially considering relative lack of formal employment in the region and potential cultural differences between local and foreign workforce



Physical intrusion and nuisance impacts	No	Unlikely, as permanent settlements are relatively far away from the AR-SIPVPP areas, which would negate potential disturbance from any acoustic, vibration, visual and air quality impacts resulting from AR-SIPVPP-CW
Project-sponsored social investment/ development projects	No	Depends on Project's commitment in terms of social investment, which is generally limited during early project phases.

13.3 Legislative Framework

13.3.1 National Standards

National legislation prescribing consideration of socio-economic impacts is relatively limited and with requirements limited to Article 5, of the General Environmental Regulations and Rules of Implementation (GERRI) Act, which requires the ESIA process to (a.) identify the nature and extent of environmental and social impacts resulting from the Project under study, (b.) facilitate in the achievement of national and corporate environmental and social objectives and (c.) engage stakeholders and Public.

13.3.2 International Standards

With regards to International Good Practice Guidance, the following IFC PSs are relevant to the consideration of social effects in the context of this Project.

- IFC Performance Standards recognize the potential for projects to impact upon marine and aquatic resources, their use and related livelihoods. IFC PS sets requirements for avoiding or minimizing negative impacts on livelihoods and ecosystem services, including fishing livelihoods (If any) that are affected by project land acquisition or restrictions on access to natural resources (ecosystem services). Impacts should be identified through the ESIA process (covered in PS1), including via socio-economic survey and consultation with public.
- PS 5, which requires fair treatment of people (If any) affected by Project land acquisition and land use, including those who lose houses ('physically displaced') and those whose livelihoods are impacted ('economically displaced').

More specifically PS 5 requires:

- **Avoidance & Minimization of Displacement:** The Project should be designed to avoid or minimize displacement impacts.
- **Compensation & Entitlements:** Fair compensation should be paid to owners of affected land and assets (If any).
- The Project should not access land until fair compensation has been paid. N/A for AR-SIPVPP



- **Eligibility for Compensation & Entitlements:** Persons eligible for compensation and assistance should include: (i) those with formal, registered land & asset ownership rights' (ii) those with informal but legalized recognized rights of ownership (e.g., unregistered or customary rights); and (iii) those with no legally recognized rights (who would be eligible for compensation for structures they own, if not for the actual land on which the structure is located).
 - **Livelihood Restoration:** People whose livelihoods are impacted by a Project (e.g., Fishing activities) should be assisted so that their livelihoods are restored or preferably improved.
 - **Vulnerable Persons:** Special attention and assistance need to be given to vulnerable persons affected (If any) by displacement so that they get the compensation due to them and assistance in relocation.
 - **Documentation & Communication:** In cases of physical displacement, a Resettlement Action Plan (RAP) should be prepared. In cases of only economic displacement, a Livelihood Restoration Plan (LRP) should be prepared. The Project needs to identify those persons impacted by land acquisition and displacement and identify what entitlements and compensation people are entitled to. This information should be contained in the RAP or LRP, along with other information such as the process being followed on land acquisition, compensation and entitlements and grievance mechanism.
 - **Monitoring & Evaluation:** The Project should monitor and evaluate progress in implementing resettlement, compensation, and livelihood restoration assistance.
- PS 2 requires that a project protect the rights of workers and creates fair and safe working conditions. Under PS 2 there must be robust human resources policies and procedures, workers must be given clear terms of employment, worker accommodation must achieve specified standards, workers should be allowed to join worker organizations or create alternative mechanisms to express their grievances and protect their rights regarding working conditions and terms of employment, there must be non-discrimination and equal opportunity including between migrant and non-migrant workers and in terms of gender, and workers should have access to an adequate grievance mechanism. There are also provisions to prevent the use of child or forced labour, and the requirement to apply good international industry practice to achieve a safe and healthy work environment.
- PS 7 sets out requirements relating to Indigenous Peoples – these requirements can be complex and pose challenges for the Project. Even if a social group such as the Bedouin is not formally recognized by the national government as indigenous, they may have characteristics of



indigenous peoples common to IFC definitions and IFC may decide that PS7 requirements should apply. PS7 requirements include:

- **Avoid / minimize impacts:** Projects should avoid / minimize adverse impacts on Indigenous Peoples (IP), with mitigation such as compensation or livelihood restoration where necessary.
- **Assessment of impacts:** Projects should identify within ESIA's if and how any communities would be impacted environmentally or socially by the Project.
- **Engagement:** Projects should engage with affected IP communities (If any) as required in PS1, with engagement planning, disclosure of information, consultation and participation (ICP), in order to understand how IP communities (If any), use land areas, their sources of livelihoods, livelihood impacts and to get the participation of affected communities (If any) in identifying appropriate mitigation measures.
- **FPIC:** In certain circumstances, such as if a project locates on lands traditionally owned or customarily used by Indigenous People, Projects are required to obtain the Free Prior and Informed Consent (FPIC) of the Indigenous People – which means documented agreement from the affected IP community that land linked to the IP (If any) can be used by the Project.
- o **Land:** If the Indigenous Peoples' land or access to land (If any) is being affected, the Project should:
 - Document efforts to avoid and otherwise minimize the area of land used by the Project;
 - Identify and review all property interests and traditional resource uses prior to acquiring the land;
 - Document the affected IP community's (If any) land and resource use, including any gender specific aspects;
 - Ensure that affected IP communities (If any) are informed of their land rights under national law;
 - Offer appropriate compensation and sustainable development opportunities, including:
 - Land-based / in-kind compensation where feasible, rather than just cash compensation;
 - Continued access to similar natural resources or compensation and alternative livelihoods assistance;



- Equitable sharing of benefits associated with the Project's use of land or natural resources which are central to the identity and livelihoods of affected indigenous people (If any); and
- Provide access, usage, and transit to IP communities (If any) on land being used by the Project, where health, safety, and security considerations allow.

13.4 Spatial and Temporal Boundaries

The study area for a social assessment is generally defined as the area that is likely to experience the impacts arising from or to exert an influence on, the Project or activity being assessed (IFC, 2012). In the case of social assessment, this task is often complicated by the fact that different types of socio-economic impacts make themselves felt over different geographical areas. Generally, such impacts of a project can be divided into three broad categories:

- Impacts related to the physical intrusion of project infrastructure and project-related activities on the surrounding environment (which may include socio-economic impacts arising from land acquisition, acoustic and vibration effects, changes in the visual characteristics of the Project area). Such impacts typically extend to populations within the immediate vicinity of proposed project activities;
- Impacts related to the “economic pull” exerted by the Project (including job creation, an influx of workers and job-seekers into the Project area, increased pressure on services, as well as the concomitant risk of increased social pathologies). Such impacts usually extend to the settlements or small towns located closest to the Project; and
- Indirect or induced impacts that are by-products or ripple-effects of the impacts in the foregoing two categories. These could include multiplier effects in the local and regional economy (as a result of the creation of new jobs and project-related expenditure), macro-economic benefits of the Project, benefits derived from corporate social investment by the Project proponent and economic dependency on project benefits. The geographical reach of such impacts tends to include the larger towns or cities which are nearest to the Project site.

The relevance of this distinction for the definition of the study area stems from the fact that the type and level of baseline information required for an adequate prediction of socio-economic impacts differ between these categories. The following study areas have accordingly been defined for the purpose of the social assessment corresponding to the three categories of impacts listed above:



- *The site-specific study area* – the area likely to experience impacts related to the physical intrusion of Project infrastructure and Project-related activities. This study area is defined as the areas in the immediate vicinity (2km) of proposed AR-SIPVPP-CW.

13.5 Baseline Methodology

13.5.1 Introduction

The study was designed with consideration of national legislative requirements, such as those stipulated in the Article 5, of the General Environmental Law and Rules of Implementation Act. Relevant international best-practice standards, in particular, the International Finance Cooperation (IFC) Performance Standards, also informed the study. The activities undertaken as part of the study are outlined below.

13.5.3 Baseline Data Collection Methods

This report is based on information obtained through the following data collection activities:

- *Visual inspection and analysis of available satellite imagery* to identify likely land use activities
- *A desktop review* of available documents was conducted to obtain relevant baseline socio-economic information on the potentially impacted areas.
- *Consideration of findings of reconnaissance site visits as documented in reconnaissance site-visit report and associated imagery*
- *Consideration of information from other specialist studies:* social issues often overlap with other issues, such as visual impacts, impacts on fauna and flora, cultural heritage, etc. Therefore, although these may have been dealt with in other specialist studies, their interrelationship with social concerns should not be overlooked. Relevant information was obtained from specialists, as well as the ESIA on the anticipated biophysical impacts that could give rise to indirect socio-economic impacts.
- Data gleaned from the aforementioned activities and sources were used to compile a socio-economic baseline profile of the study

13.6 Socio - Economic status of Ar Rass

This part of the Socio-Economic Impact Assessment (SEIA) identifies the key socio-economic issues associated with the development of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass, during construction and operational phases. The significance of proposed development on the local economy and amenity issues is also assessed where necessary, potential mitigation measures have been suggested through this study.



Methodology

This Socio-Economic Impact Assessment (SEIA) is designed to assess the potential effect on the communities either positive or negative by the development of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass. Community is often the most highly valued aspect of socio-economic study. Community wellness is the term generally used to assess the social structures of a community. The state of community wellness depends on the wellbeing of all aspects of a community, individuals, families and the community as a whole. It may be significantly enhanced by project benefits and vulnerable to adverse effects. The community-driven approach is the most famous tool to assess the socio-economic aspect for any development project. This approach to assessing the effects of the project is community-focused, addressing community concerns. The aim is to design this study is to optimize the effects from Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass on residents as beneficial to their communities or the effects they believe are undesirable. In order to assess the potential social and economic impacts associated with the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass community-driven based assessment is undertaken comprising the following tasks:

- Review of indigenous communities' status located nearest to the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Project in relation to their role and rights;
- The identification of potential impact on the community social activities in relation to construction and operation of the AR-SIPVPP Project;
- An assessment of project skill requirements in relation local skill availability for the development;
- An assessment of potential social and economic impacts including the operation of the AR-SIPVPP Project, local services and resources in future;
- A qualitative assessment of potential health and safety issues associated with the operation and maintenances of AR-SIPVPP Project.

Purpose and Objectives

The purpose of this study is to represent the relevant and currently available information on the recent existing background and expected circumstances of the communities and people that might be affected by the operation of AR-SIPVPP Project. This section takes an issues-focused approach on baseline information. The focus is on community wellness, which is a deliberately broad term that includes the physical, emotional, social, cultural and economic well-being of a community, including individuals, families and the community as a whole. The objective is to identify the indicators of these various aspects of community, interrelationships between them and the influences acting on them, within the limited available data. The socio-economic study in this



report is divided into two parts, first part describes the socio-economic baseline condition of the study area through the indicators are as follows:

- People and the economy;
- Infrastructure and community services;
- Individual, family and community wellness;
- Traditional culture;
- Non-traditional land and resource use;
- Heritage resources

The Socio-Economic Impact Assessment (SEIA) methodology and the possible effect from the construction and operational phases of the AR-SIPVPP Project are discussed in this study.

Legal Requirements

Saudi National Legislations

The Labour Law (Royal Decree No. M151, 2005) defines the regulation of employment, labor relations, worker contracts and work place conditions. This law contains provisions intended to protect the interests of both employers and employees with the aim of establishing a stable, equitable and sustainable work environment. This law will therefore provide a minimum legal basis for the engagement of the workforce for AR-SIPVPP Project. The working conditions and worker housing.

This law also specifically addresses such issues as protection against occupational hazards; major industrial accidents and work injuries, health and social services.

This law will apply to the construction and operational workforce as well as to both the project company staff and all contractors.

Equator Principle II 2020

Principle 1: Review and Categorization When a Project is proposed for financing, the EPFI will, as part of its internal environmental and social review and due diligence, categorize it based on the magnitude of its potential environmental and social risks and impacts. Such screening is based on the environmental and social categorization process of the International Finance Corporation (IFC). Using categorization, the EPFI's environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts.

The categories are:

Category A – Projects with potential significant adverse environmental and social risks and/or impacts that is 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 measures; and

Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

Principle 2: Environmental and Social Assessment For all Category A and Category B Projects, the EPFI will require the client to conduct an Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and impacts of the proposed Project (which may include the illustrative list of issues found in Exhibit II). The Assessment Documentation should propose measures to minimize, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed AR-SIPVPP Project. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A, and as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialized studies may also need to be undertaken. Furthermore, in limited high-risk circumstances, it may be appropriate for the client to complement its Assessment Documentation with specific human rights due diligence. For other Projects, a limited or focused environmental or social assessment (e.g. audit), or straight-forward application of environmental siting, pollution standards, design criteria, or construction standards may be carried out. For all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of CO₂ equivalent annually, an alternatives analysis will be conducted to evaluate less Greenhouse Gas (GHG) intensive alternatives. Refer to Annex A for alternatives analysis requirements.

Other principles are listed below:

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 Covenants

Principle 9: Independent Monitoring and Reporting

Principle 10: Reporting and Transparency

According to the classification above, the proposed AR-SIPVPP Project is a Category A project.



IFC Requirements

Applicable Requirements for Working Conditions and Management of Worker Relationship	
Performance Standard 1: Social and Environmental Assessment and Management Systems	
Performance Standard 2: Labor and Working Conditions	
Human Resources Policy	The client will adopt a human resources policy appropriate to its size and workforce that sets out its approach to managing employees consistent with the requirements of this Performance Standard.
Working Relationship	The client will document and communicate to all employees and workers directly contracted by the client their working conditions and terms of employment, including their entitlement to wages and any benefits.
Working Conditions and Terms of Employment	The client will provide reasonable working conditions and terms of employment that, at a minimum, comply with national law.
Workers' Organizations	The client will enable alternative means for workers to express their grievances and protect their rights regarding working conditions and terms of employment.
Non-Discrimination and Equal Opportunity	The client will not make employment decisions based on personal characteristics unrelated to inherent job requirements,
Grievance Mechanism	The client will provide a grievance mechanism for workers (and their organizations, where they exist) to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hire, and make it easily accessible to them.
Performance Standard 4: Community Health, Safety and Security;	
General Requirements	The client will evaluate the risks and impacts to the health and safety of the affected community during the design, construction, operation, and decommissioning of the project and will establish preventive measures to address them in a manner commensurate with the identified risks and impacts.
Infrastructure and Equipment Safety	The client will design, construct, and operate and decommission the structural elements or components of the project in accordance with good international industry practice
Hazardous Materials Safety	The client will prevent or minimize the potential for community exposure to hazardous materials that may be released by the project.



Applicable Requirements for Working Conditions and Management of Worker Relationship

Environmental and Natural Resource Issues	The client will avoid or minimize the exacerbation of impacts caused by natural hazards, such as landslides or floods that could arise from land use changes due to project activities. The client will also avoid or minimize adverse impact due to project activities on soil, water, and other natural resources in use by the affected communities. The client will prevent or minimize the potential for community exposure to water- borne, water- based, water-related, vector- borne disease, and other communicable diseases that could result from project activities
Emergency Preparedness and Response	The client will assess the potential risks and impacts from project activities and inform affected communities of significant potential hazards in a culturally appropriate manner.
Security Personnel Requirements	When the client directly retains employees or contractors to provide security to safeguard its personnel and property, it will assess risks to those within and outside the project site posed by its security arrangements.

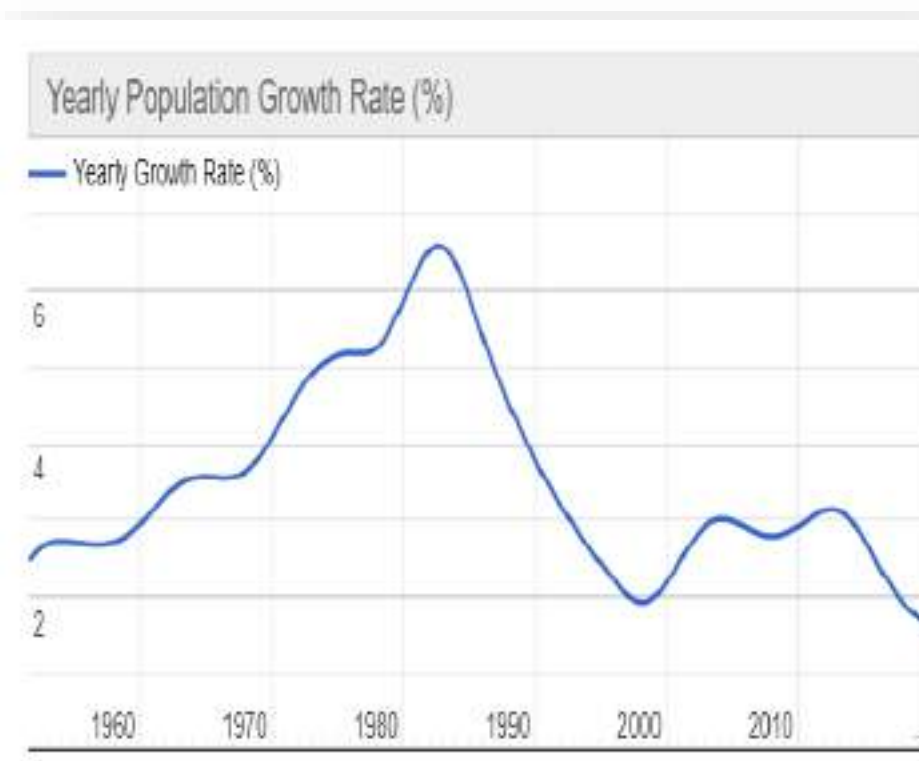
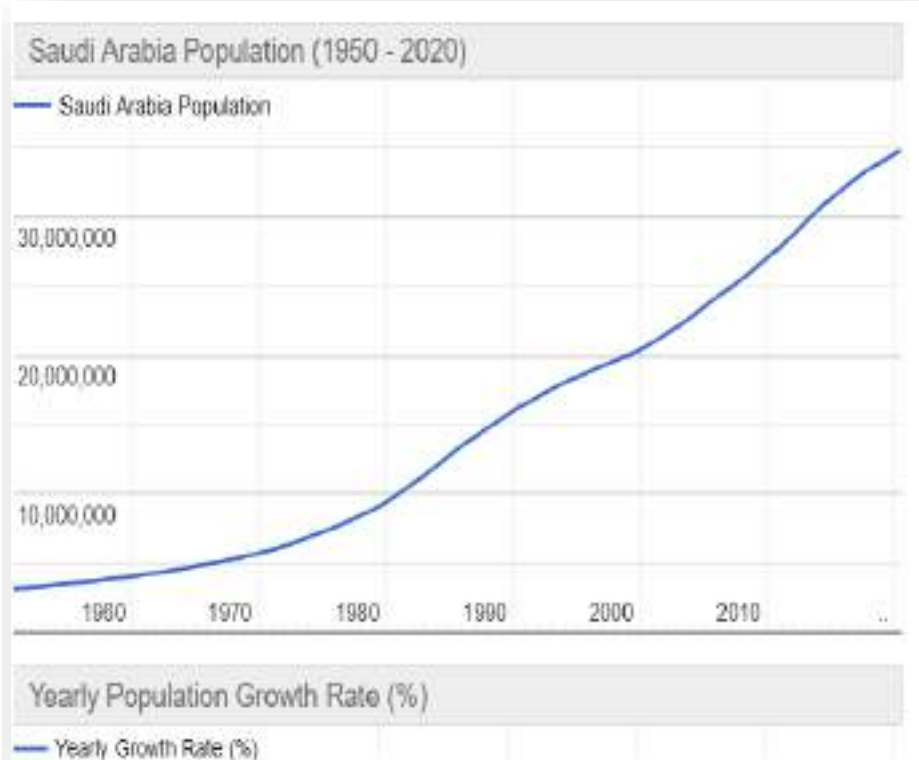
Performance Standard 5: Land Acquisition and Involuntary Resettlement

Performance Standard 7: Indigenous Peoples

- The current population of **Saudi Arabia** is 36,518,609 as of Monday 11th July 2023 10.30 PM, based on Worldometer elaboration of the latest United Nations data.
- Saudi Arabia 2020 population is estimated at **34,813,871** people at mid-year according to UN data.
- Saudi Arabia population is equivalent to **0.45%** of the total world population.
- Saudi Arabia ranks number **41** in the list of countries (and dependencies) by population.
- The population density in Saudi Arabia is 16 per Km² (42 people per mi²).
- The total **land** area is 2,149,690 Km² (830,000 sq. miles)
- **84.0 %** of the population is **urban** (29,255,576 people in 2020)
- The **median age** in Saudi Arabia is **31.8 years**.



Saudi Arabia Population (LIVE) : Monday 11th July 2023 10.30 PM





Population of Saudi Arabia (2022 and Historical)

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Saudi Arabia Global Rank
2023	36,947,025	1.48 %	538,205	28,998	30.6	2.36	17	83.5 %	30,846,442	0.46 %	8,045,311,447	40
2022	36,408,820	1.28 %	458,424	28,998	30.2	2.39	17	83.3 %	30,329,753	0.46 %	7,975,105,156	41
2020	35,997,107	0.47 %	169,745	-1,025,295	29.2	2.47	17	81.3 %	29,255,576	0.46 %	7,840,952,880	41
2015	32,749,848	2.17 %	667,584	60,337	28.3	2.64	15	80.2 %	26,249,243	0.44 %	7,426,597,537	41
2010	29,411,929	3.81 %	1,002,857	236,962	25.3	2.85	14	76.5 %	22,512,101	0.42 %	6,985,603,105	40
2005	24,397,644	2.52 %	570,051	481,349	23.2	3.24	11	79.3 %	19,358,664	0.37 %	6,558,176,119	46
2000	21,547,390	2.67 %	531,707	17,241	21.2	4.12	10	76.9 %	16,579,826	0.35 %	6,148,898,975	48
1995	18,888,857	3.37 %	576,819	27,095	19.3	4.95	9	78.0 %	14,739,559	0.33 %	5,743,219,454	48
1990	16,004,763	4.42 %	622,904	186,898	18.2	5.83	7	78.1 %	12,503,513	0.30 %	5,316,175,862	51
1985	12,890,245	4.85 %	543,707	163,926	17.0	6.70	6	74.3 %	9,581,553	0.27 %	4,861,730,613	53
1980	10,171,710	5.19 %	454,833	148,004	16.2	7.19	5	63.1 %	6,415,124	0.23 %	4,444,007,706	58
1975	7,897,544	5.28 %	358,271	132,741	16.6	7.37	4	54.9 %	4,334,558	0.19 %	4,069,437,231	65
1970	6,106,191	4.17 %	225,454	63,988	16.2	7.58	3	46.5 %	2,840,506	0.17 %	3,695,390,336	75
1965	4,978,922	3.63 %	162,672	28,951	16.1	7.66	2	37.7 %	1,877,805	0.15 %	3,337,111,983	83
1960	4,165,563	3.07 %	116,731	7,608	16.5	7.63	2	30.7 %	1,277,054	0.14 %	3,019,233,434	81
1955	3,581,910	3.00 %	98,443	2,108	17.3	7.59	2	25.8 %	923,917	0.13 %	2,746,072,141	83

Source: **Worldometer** (www.Worldometers.info)

Elaboration of data by United Nations, Department of Economic and Social Affairs, Population Division. [World Population Prospects: The 2022 Revision](#). (Medium-fertility variant).



Saudi Arabia Population Forecast

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km ²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Saudi Arabia Global Rank
2020	34,709,640	1.92 %	630,499	118,000	31.9	2.48	16	78.4 %	27,202,447	0.45 %	7,795,482,309	41
2025	37,290,305	1.44 %	516,133	60,000	33.2	2.29	17	78.0 %	29,085,517	0.46 %	8,185,613,757	42
2030	39,480,349	1.15 %	438,009	60,000	34.7	2.14	18	77.5 %	30,602,519	0.46 %	8,551,198,644	42
2035	41,317,419	0.91 %	367,414	60,000	36.0	2.02	19	77.4 %	31,999,465	0.46 %	8,892,701,940	42
2040	42,777,611	0.70 %	292,038	40,000	37.2	1.92	20	78.0 %	33,376,063	0.46 %	9,210,337,004	45
2045	44,026,516	0.58 %	249,781	40,000	38.5	1.84	20	78.8 %	34,697,663	0.46 %	9,504,209,572	46
2050	45,056,349	0.46 %	205,967	40,000	39.6	1.78	21	79.5 %	35,838,611	0.46 %	9,771,822,753	45

: **Worldometers** (www.worldometers.info/) , Department of Economic and Social Affairs, Population Division. [World Population Prospects: The 2020 Revision](#). (Medium-fertility variant).



Kingdom of Saudi Arabia
Ministry of Economy and Planning
Central Department of Statistics and Information



المملكة العربية السعودية
وزارة الاقتصاد والتخطيط
مصلحة الإحصاءات العامة والمعلومات

خرائط توزيعات النتائج الأولية
Distributions Maps of preliminary results
Population and Housing Census
2010
للتعداد العام للسكان والمساكن
١٤٣١هـ





Location:

The Kingdom of Saudi Arabia lies at the furthestmost part of southwestern Asia. It is bordered in the north by Kuwait, Iraq and Jordan, in the east by the Arabian Gulf, United Arab Emirates and Qatar, in the south by Yemen and Oman, and in the west by the Red Sea.

الموقع:

تقع المملكة العربية السعودية في أقصى الجنوب الغربي من قارة آسيا حيث يحدها شمالاً كل من الكويت والعراق والأردن ولبنان والخليج العربي والإمارات العربية المتحدة وقطر وجنوباً اليمن وسلطنة عمان وغرباً البحر الأحمر.

خريطة المملكة العربية السعودية Kingdom of Saudi Arabia Map

The Kingdom General Location

Kingdom Administrative Division

الموقع العام للمملكة

التقسيم الإداري للمملكة



Administrative Division

The Kingdom of Saudi Arabia is divided into 13 regions (amman). In addition to the headquarters of the region (amman), each region is divided into a number of governorates. The following table shows the regions (amman) of the Kingdom.

التقسيم الإداري

تقسم المملكة العربية السعودية إلى 13 منطقة إدارية (إمارة). وتضاف المنطقة الإدارية إلى مركز الإمارة، حيث تنقسم المنطقة الإدارية إلى عدد من المحافظات. ويوضح الجدول التالي التقسيم الإداري للمملكة.

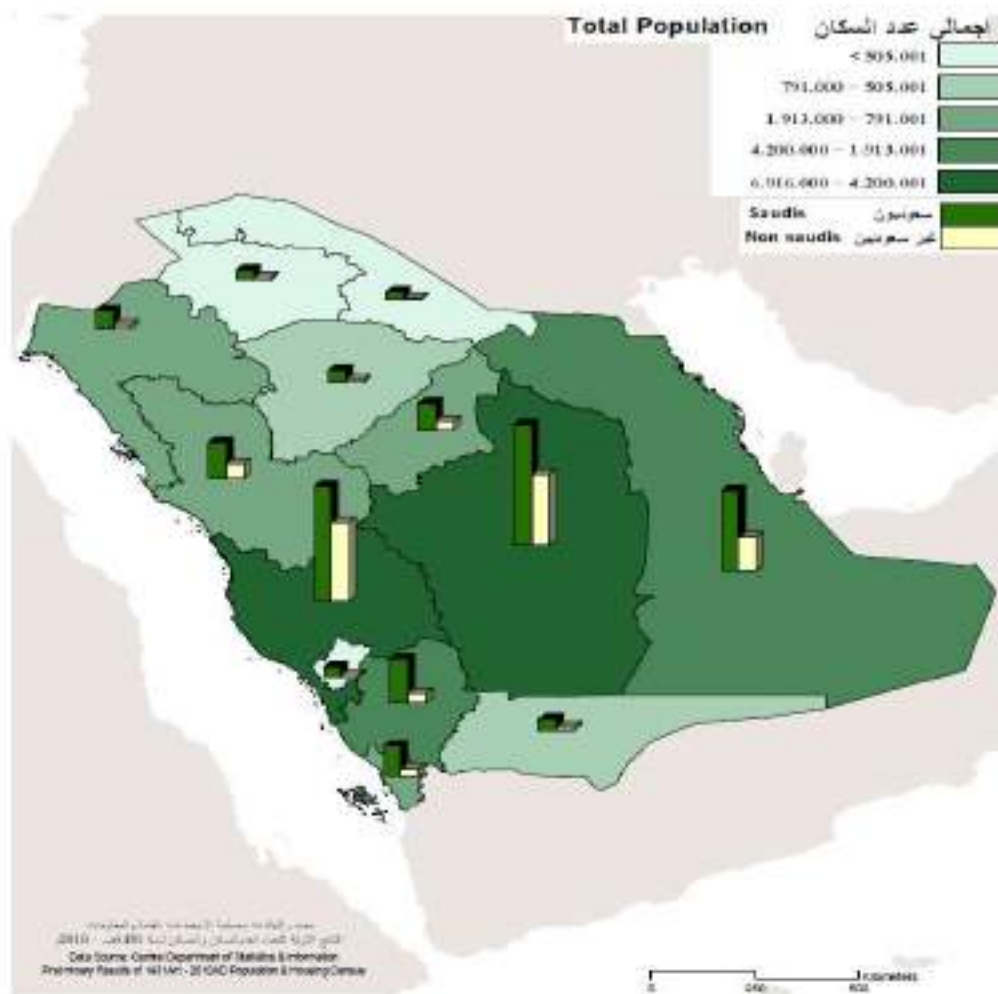
عدد المحافظات No. of Governorates	المنطقة الإدارية Region
19	الرياض Al-Riyadh
11	مكة المكرمة Makkah Al-Mukarramah
6	المنطقة الشرقية Al-Madinah Al-Sharqiah
18	القصيم Al-Qaseem
10	المنطقة الشرقية Eastern Region
11	البحر Bahr
8	تبوك Tabouk
3	حائل Hail
2	الحدود الشمالية Northern Borders
13	جدة Jeddah
7	نجران Najran
6	الجازن Jazan
2	الجوف Al-Jouf



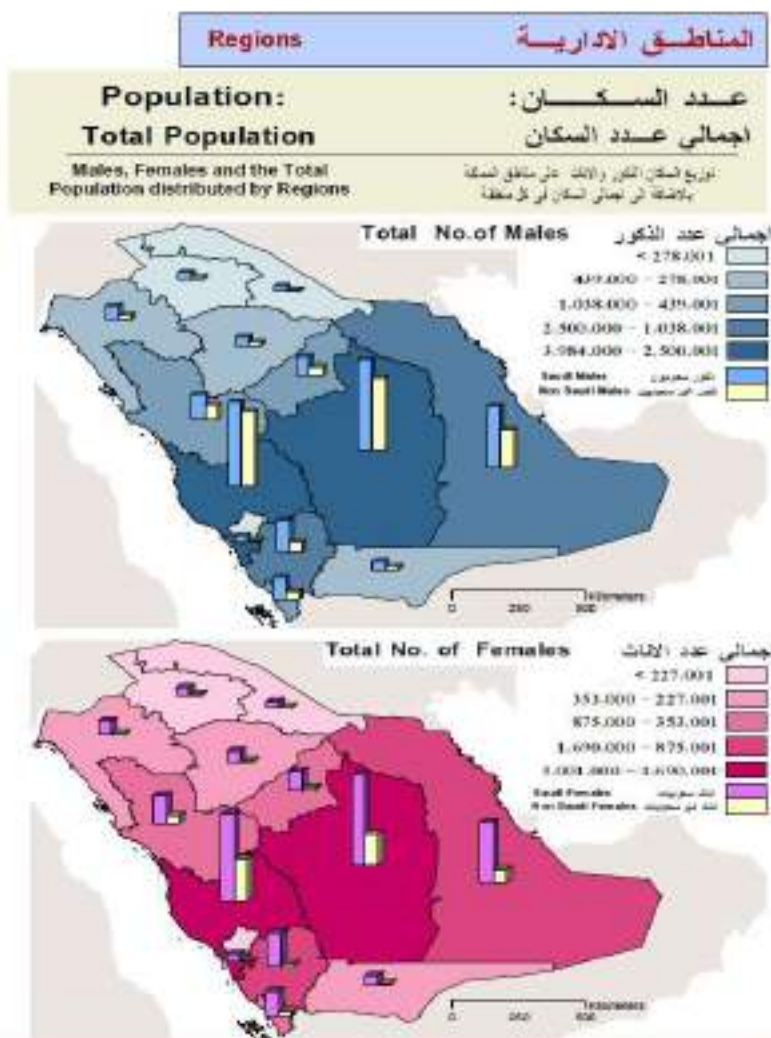
التقسيم الإداري للمملكة العربية السعودية (مخالفات)



مصلحة الإحصاءات العامة والمعلومات



Central Department of Statistics & Information



مصلحة الإحصاءات العامة والمعلومات



Location:

Eastern Region is located in the west part of the Kingdom. It is bordered in the north by Kuwait, Iraq and the Northern Region, in the east by the Arabian Gulf, United Arab Emirates and Qatar, in the south by The Sultanate of Oman, and in the west by the regions of Al-Riyadh, Al-Qassim, and Najran.

الموقع:

تقع المنطقة الشرقية في شرق المملكة العربية السعودية ويحدها شمالاً دولة الكويت وجمهورية العراق ومنطقة الحدود الشمالية وشرقاً الخليج العربي ودولة الإمارات العربية المتحدة ودولة قطر وسلطنة عمان وجنوباً سلطنة عمان وعمراً مناطق الرياض والقصيم ونجران.

Eastern Region
General Location

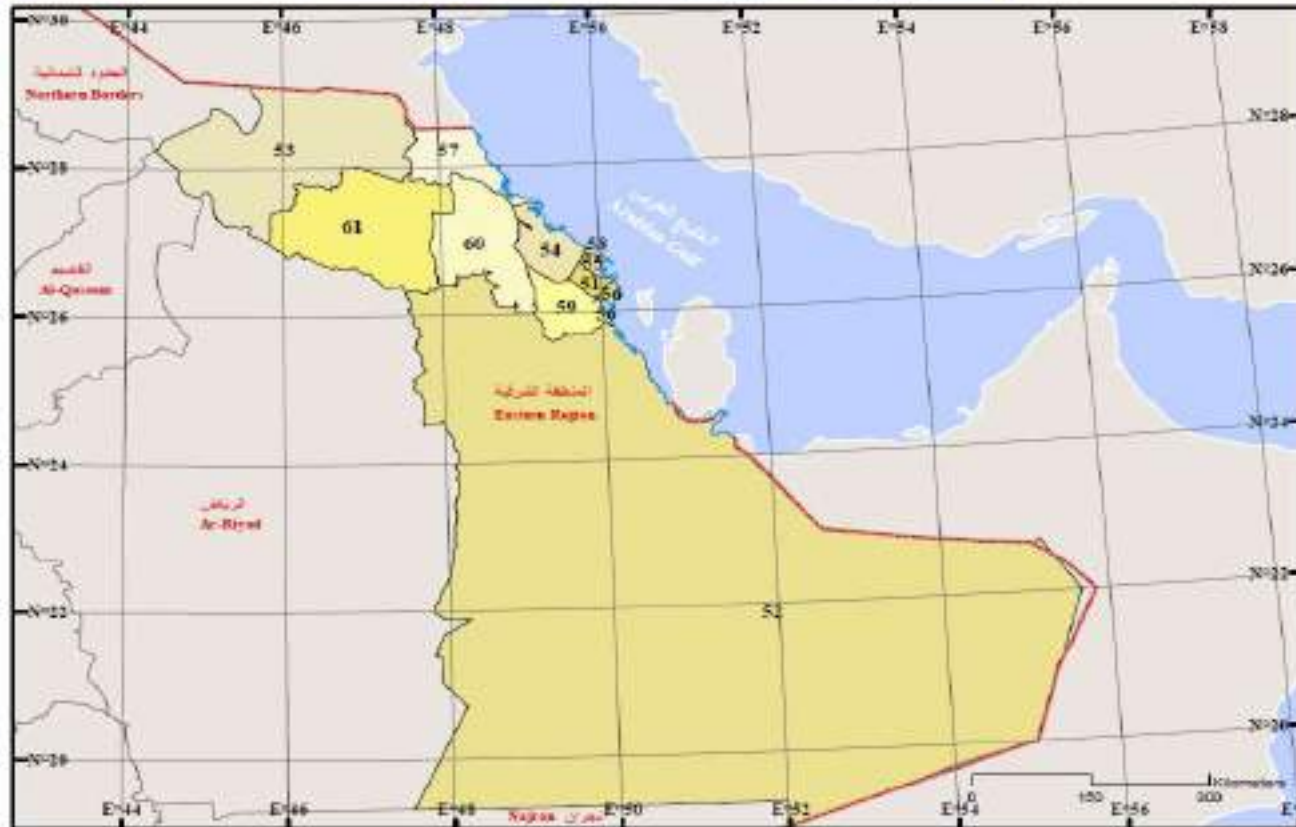
المنطقة الشرقية
الموقع العام

Eastern Region Governorates

محافظات المنطقة الشرقية

منطقة الشرقية
Eastern Region

الموقع العام
General Location



Governorates:
Eastern Region is divided into the emirate quarter and two governorates. The following table shows Eastern Region's governorates:

المحافظات

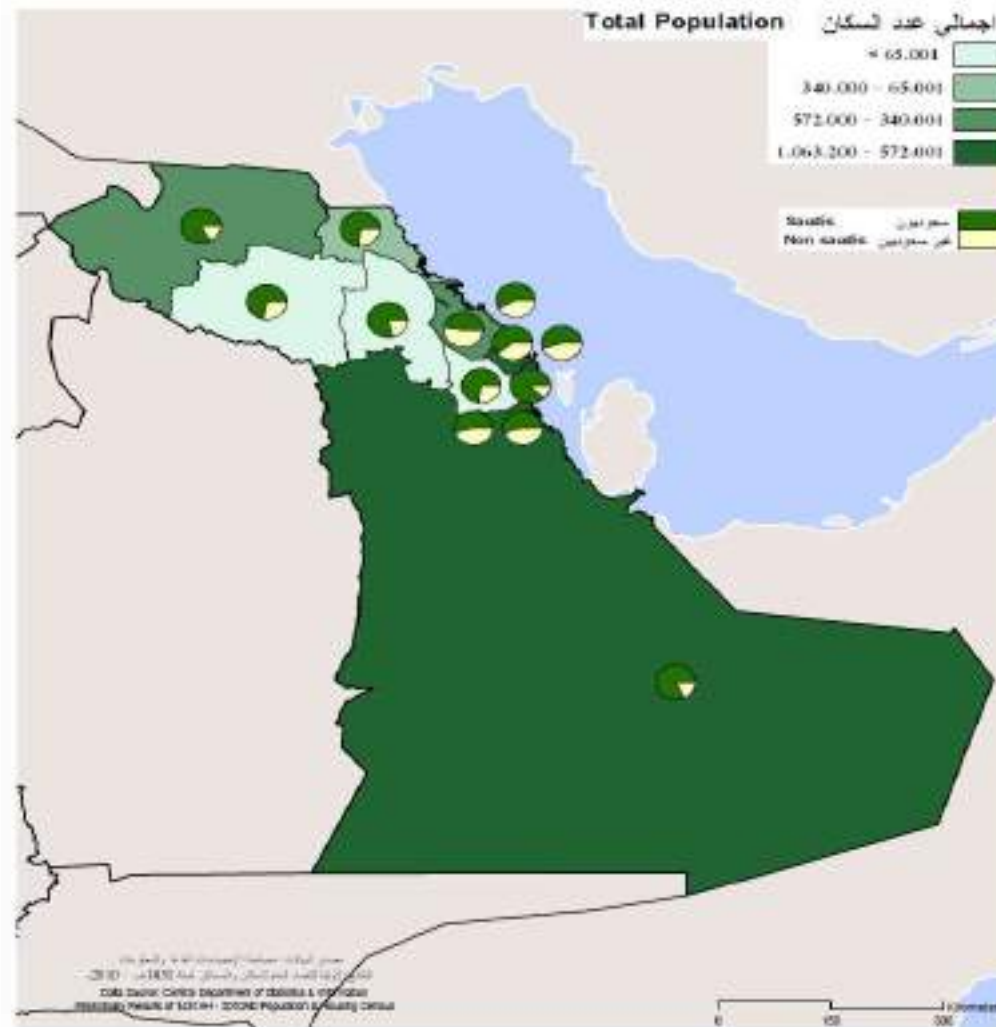
تتقسم المنطقة الشرقية إلى مقر الإمارة ومقر محافظتين. ويوضح الجدول التالي أسماء المحافظات:

Governorate	الرمز Code	المحافظة
Ad-Dammam	*51	الدمام
Al-Ahsa	52	الأحساء
Hafr Al-Batin	53	حفر الباطن
Al-Jubail	54	الجبيل
Al-Qatif	55	القطيف
Al-Khobar	56	الخبر
Al-Khaffj	57	الخفجي
Ras Tanurah	58	راس تنورة
Buqayq	59	بقيق
Al-Nayrivyah	60	النعيمة
Qatif Al-Ula	61	قربة العليا

* Emirate Quarter

* مقر الإمارة

تم إعداد الخريطة باستخدام برنامج ArcMap 10.2.1
الخريطة هي ملكية شركة كـوـا باور كـسـا
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Eastern Region

المنطقة الشرقية

Population:

عدد السكان:

Saudis and Non Saudis

سعوديون وغير سعوديين

The distribution of males, females and the total population for Eastern Region Governorates

توزيع الذكور والإناث و إجمالي السكان على محافظات المنطقة الشرقية

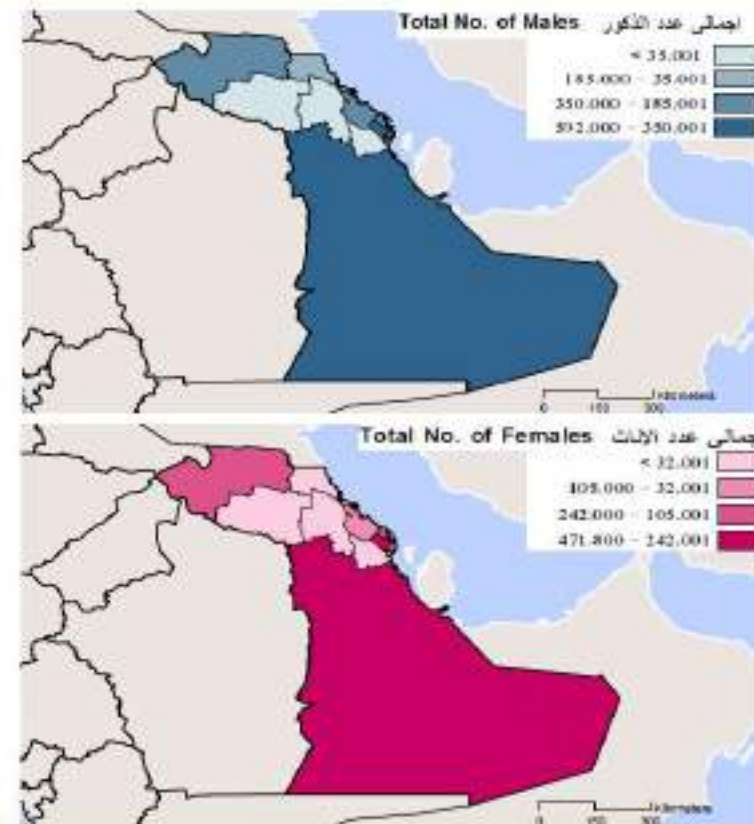




Table: Population by nationality and region, KSA,

Eastern	1,838,059	1,103,177	2,941,236

Table : Rate of MOH hospital beds per 10,000 population by region, KSA,

Eastern	2,941,236	3,056	10.4

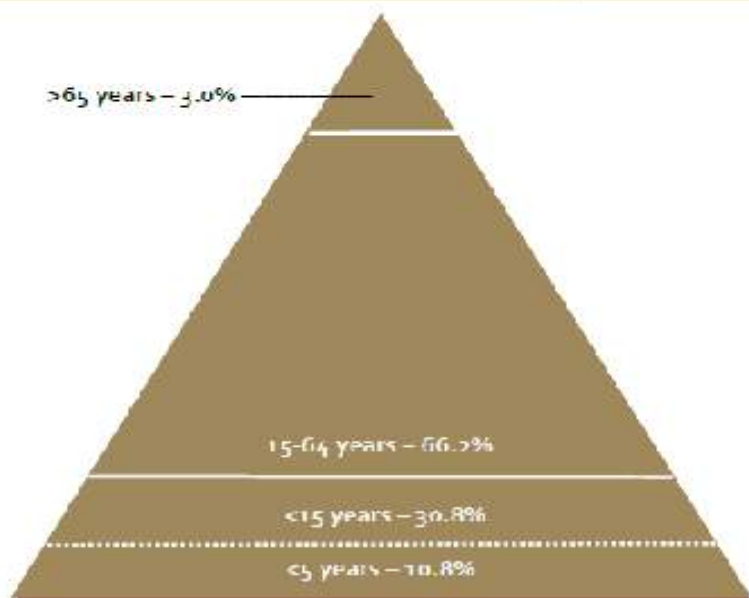


Figure 1.3: Population age-groups pyramid,

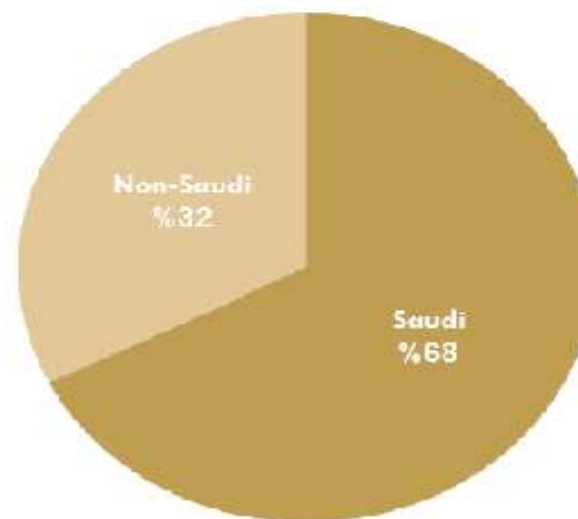


Figure 1.4: Population distribution by nationality,

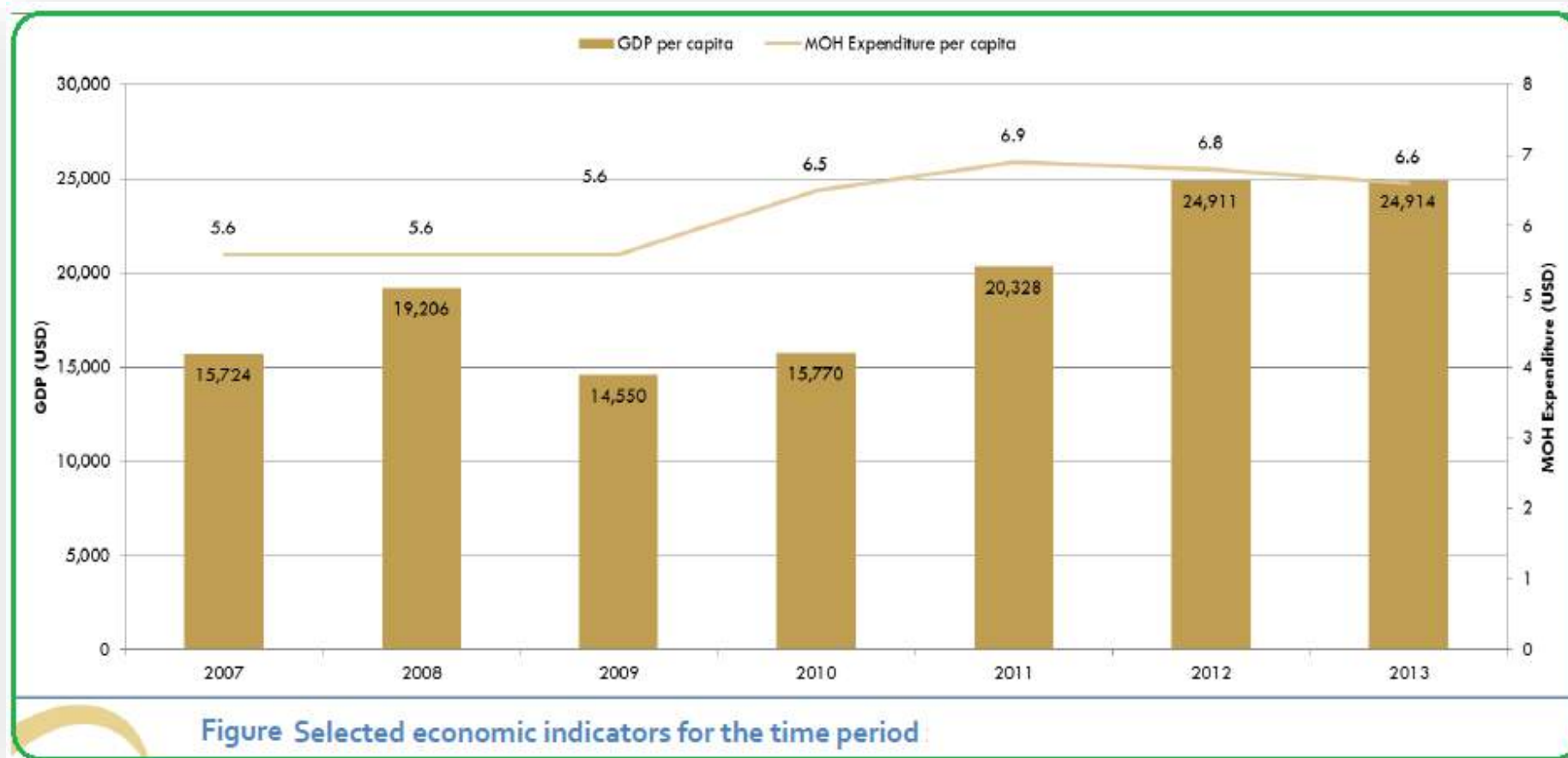




Table : Total MOH facilities by region,

Forensic Medicine	18
Anti-smoking clinics	236
Health centers control at entry points	1
Central laboratories	1
Rehabilitation centers	2
Dialysis Center	1
Diabetes Center	21
Dental centers	1
Oncology Center	1
Cardiology Center	1
PHC centers	4
Hospitals	3
Regions	1

Saudi Arabia Population by Year (Historical)

Year	Population	% Male	% Female	Density (km ²)	Population Rank	Growth Rate
2019	34,140,662	57.40%	42.60%	15.88	41	1.75%
2018	33,554,343	57.26%	42.74%	15.61	41	1.87%
2017	32,938,213	57.07%	42.93%	15.32	41	2.05%
2016	32,275,687	56.87%	43.13%	15.01	41	2.28%
2015	31,557,144	56.70%	43.30%	14.68	41	2.85%
2010	27,425,676	56.15%	43.85%	12.76	45	2.79%
2005	23,905,654	55.66%	44.34%	11.12	46	2.86%
2000	20,764,312	54.46%	45.54%	9.66	48	2.08%
1995	18,735,841	55.48%	44.52%	8.72	48	2.79%
1990	16,326,815	56.01%	43.99%	7.59	51	4.36%
1985	13,189,115	54.90%	45.10%	6.14	52	6.25%
1980	9,740,599	53.64%	46.36%	4.53	61	5.57%



Year	Population	% Male	% Female	Density (km ²)	Population Rank	Growth Rate
1975	7,428,703	52.02%	47.98%	3.46	72	4.94%
1970	5,836,389	50.91%	49.09%	2.71	76	3.80%
1965	4,843,635	50.46%	49.54%	2.25	78	3.46%
1960	4,086,539	50.22%	49.78%	1.90	83	2.81%
1955	3,558,155	50.44%	49.56%	1.66	84	2.65%
1950	3,121,335	50.75%	49.25%	1.45	85	0.00%
Year	Population	% Male	% Female	Density (km ²)	Population Rank	Growth Rate
2020	34,709,640	57.47%	42.53%	16.15	41	0.00%
2025	37,290,305	57.02%	42.98%	17.35	42	1.44%
2030	39,480,349	56.62%	43.38%	18.37	42	1.15%
2035	41,317,419	56.23%	43.77%	19.22	42	0.91%
2040	42,777,611	55.73%	44.27%	19.90	45	0.70%
2045	44,026,516	55.22%	44.78%	20.48	46	0.58%
2050	45,056,349	54.73%	45.27%	20.96	45	0.46%
2055	45,790,676	54.27%	45.73%	21.30	48	0.32%
2060	46,184,561	53.89%	46.11%	21.48	50	0.17%
2065	46,272,457	53.59%	46.41%	21.53	51	0.04%
2070	46,160,345	53.36%	46.64%	21.47	52	-0.05%
2075	45,951,118	53.18%	46.82%	21.38	52	-0.09%
2080	45,698,635	53.02%	46.98%	21.26	52	-0.11%
2085	45,406,141	52.85%	47.15%	21.12	53	-0.13%
2090	45,043,753	52.67%	47.33%	20.95	53	-0.16%
2095	44,589,081	52.48%	47.52%	20.74	53	-0.20%



Key Data

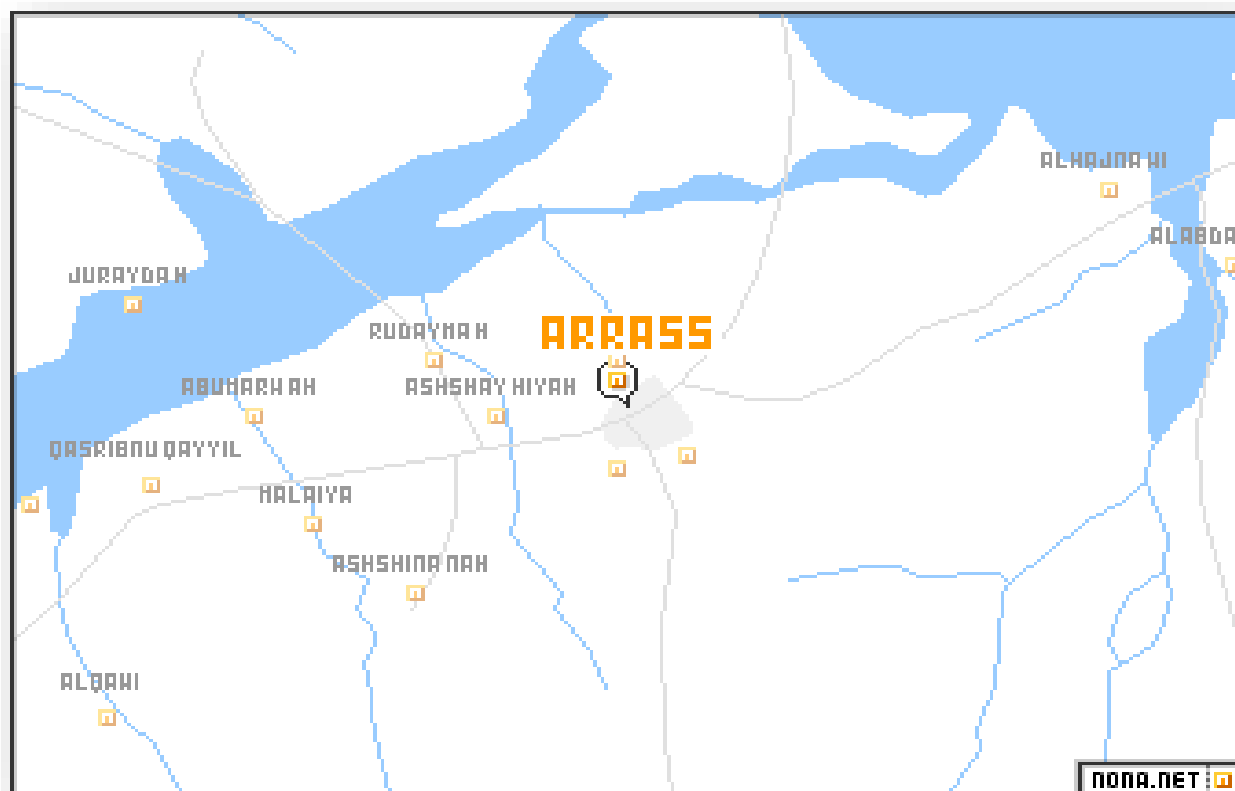
	2011	2012	2013	2014	2015	2016	2017E	2018F	2019F
Nominal GDP									
(SR billion)	2,517	2,760	2,800	2,836	2,454	2,419	2,564	2,817	3,052
(\$ billion)	671	736	747	756	654	645	684	751	814
(% change)	27.1	9.6	1.5	1.3	-13.5	-1.4	6.0	9.8	8.4
Real GDP (% change)									
Oil	12.2	5.1	-1.6	2.1	5.3	3.6	-3.0	1.5	3.3
Non-oil private sector	8.1	5.6	7.0	5.4	3.4	0.1	0.7	1.1	1.8
Non-oil government	8.4	5.3	5.1	3.7	2.7	0.6	1.7	2.2	1.7
Total	10.0	5.4	2.7	3.7	4.1	1.7	-0.7	1.5	2.4
Oil indicators (average)									
Brent (\$/b)	112	112	110	99	52	43	54	60	65
Saudi (\$/b)	104	106	104	96	49	41	51	58	61
Production (million b/d)	9.3	9.8	9.6	9.7	10.2	10.4	10.0	10.1	10.3
Budgetary indicators (SR billion)									
Government revenue	1,118	1,247	1,156	1,044	616	519	696	755	843
Government expenditure*	838	916	994	1,140	999	935	926	978	1,006
Budget balance	280	331	162	-96	-383	-416	-230	-223	-163
(% GDP)	11.1	12.0	5.8	-3.4	-15.6	-17.2	-9.0	-7.9	-5.3
Gross public debt	135	99	60	44	142	317	443	560	673
(% GDP)	5.4	3.6	2.1	1.6	5.8	13.1	17.3	19.9	22.0
Monetary indicators (average)									
Inflation (% change)	3.7	2.9	3.5	2.7	2.2	3.4	-0.3	5.2	0.2
SAMA base lending rate (% end year)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.5	3.0
External trade indicators (\$ billion)									
Oil export revenues	318	337	322	285	153	137	159	180	199
Total export revenues	365	388	376	342	204	184	210	232	255
Imports	120	142	153	158	159	128	117	120	127
Trade balance	245	247	223	184	44	56	93	112	128
Current account balance	159	165	135	74	-57	-28	9	28	44
(% GDP)	23.6	22.4	18.1	9.8	-8.7	-4.3	1.2	3.8	5.5
Official reserve assets	544	657	726	732	616	534	496	474	458
Social and demographic indicators									
Population (million)	28.2	28.9	29.6	30.3	31.0	31.7	32.6	33.3	33.9
Saudi Unemployment (15+, %)	12.4	12.1	11.7	11.7	11.5	12.5	12.8	11.8	11.0
GDP per capita (\$)	23,827	25,471	25,223	24,962	21,095	20,318	20,968	22,585	24,027

Note*: 2016 Government expenditure includes SR105 billion in due payments for previous years

Sources: Jadwa Investment forecasts for 2018 to 2019. Saudi Arabian Monetary Agency for GDP, monetary and external trade indicators. Ministry of Finance for budgetary indicators. General Authority for Statistics and Jadwa Investment estimates for oil, social and demographic indicators.



AR RASS: SOCIO-ECONOMIC INFORMATION

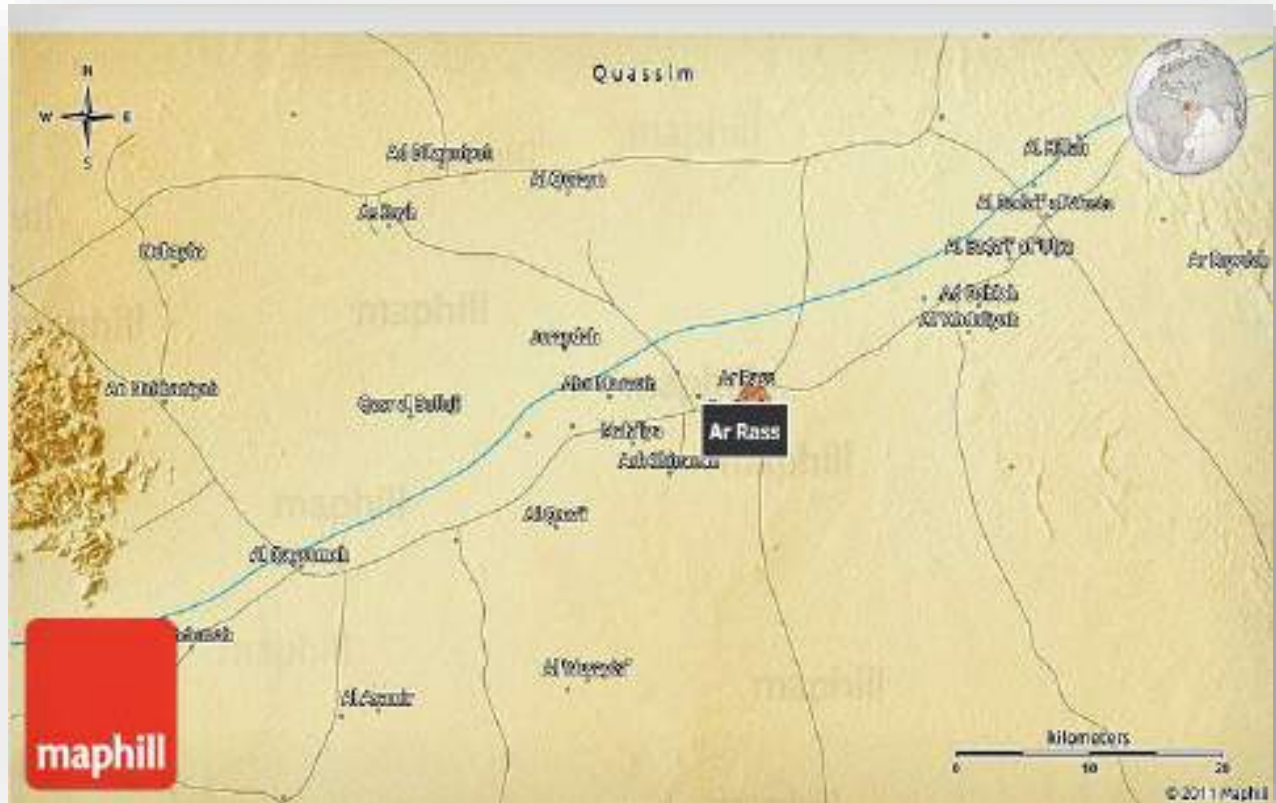




Ar Rass, Information

Hail Province, Saudi Arabia on the map, where it is located. Latitude and longitude coordinates:

43.0243477, 27. 069917. It is a village in Easter Province of Saudi Arabia



Ḥa'il Province (Arabic: *مِنطَاقَة حَائِل* *Minṭaqat Ḥā'il*), also known as the **Ha'il Region**, is one of the 13 provinces of the Kingdom of Saudi Arabia. It is the eighth-largest province by area at 103,887 km² (40,111 sq mi) and the ninth-largest by population, with the population in 2019 being 731,147. The province accounts for roughly 2% of the population of the country and is named for its largest city, Ha'il. Other populous cities in the province include al-Ghazalah, Shinan and Baq'aa. The region is famous for the twin mountain ranges of 'Aja and Salma, and for being the homeland of historic symbol of curiosity and generosity, Hatim al-Ta'i.

The province is popular for hosting the geographically and historically important twin mountain ranges of 'Aja and Salma, which are now areas protected by the Saudi Wildlife Authority. In addition, multiple rock art sites can be found in the province, two sites of which have been added to the UNESCO World Cultural Heritage Site List; Jabal Umm Sinman near Jubbah and Jabal al-Manjur.



Multiple old forts and castles can be found in the region, especially in and around the capital, Ha'il. Another important site in the province are the sandstone formations, such as the Nafud al-Kabir formation.

The area is known to have been inhabited since at least the Paleolithic period, with several archaeological sites dating back to 10000 BC to 7500 BC. Several sites with archaeological rock art and other artifacts have been found in the province. The province is inhabited by members of the Shammar tribe, who ruled the area and other areas surrounding the province from 1791 to 1922 as the Emirate of Jabal Shammar; when King Abdulaziz conquered the region.

The province is divided into 8 governorates, and more than two-thirds of the population of the city lives in the capital city of Ha'il. The incumbent Provincial Governor is 'Abdulaziz ibn Sa'ad al-Sa'ud. It is bordered, clockwise from the north, by the Northern Borders Province, Eastern Province, Qassim Province, Madinah Province, Tabuk Province and Al Jawf Province.

SOCIO-ECONOMIC FIELD SURVEY

A field campaign was conducted on April 2023 to identify the main communities and activities in the area of the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project.

The socio-economic data was collected using household survey questionnaire, profiling guide, focus group discussion specific to issues (e.g. resource use and flow), and data at enterprise level. Information was captured on demographic profile, education, profession, health and sanitation, etc. The collected data was compiled from different studies. The study encompasses lots of information on different issues, not in depth, just an overview that may help the reader to have an idea about the AR-SIPVPP Project.

Socio Economic Effects Assessment

In order to assess the potential social and economic impact due to the construction and operational phases of AR-SIPVPP Project, the following monitoring and survey activities are conducted during the study period.

Assessment of Project Skill Requirements In Relation To Local Skill Availability

AR-SIPVPP Project will generate employment opportunities that will influence territorial and local labour market. To fulfill the possible demands of labour and suppliers the surrounding territorial area will respond. From socio-economic point of view this is a positive improvement of social as well as labour market.



Employment and Regional Economic Effects

AR-SIPVPP Project will generate a number of jobs scopes as well as the economic activities that will increase people's procurement power. The local and regional demand and supply will get forces. The employment opportunities from the AR-SIPVPP Project will influence territorial and local labour market. To fulfill the possible demands of labour and suppliers of goods and services the surrounding territorial area will respond. Due to water supply expansion, new settlement and industries in the region will increase gradually. The positive social and economic impact is expected from the AR-SIPVPP Project establishment.

Demography

AR-SIPVPP Project will generate attractive economic benefits that will affect community populations. It is expected that existing birth and death rates will be improved due to improvement of infrastructures and healthcare provider. All aspects of the project will create demands for labour and local business opportunities, and thus tend to encourage migration to regional and other centers of business activity.

Residential

Project effects on housing and accommodation will include direct and indirect demands for short- and long-term accommodation. There is no short-term accommodation effect because the project is providing housing for its employees. However, effects on housing are expected to be adverse in the Ar Rass area because of less housing is available there. Table below shows expected housing effects. These effects are expected to be low magnitude, because it is expected that the local housing business sectors will generate sufficient quantity of housing facilities.

Table: Housing Effect Attributes for AR-SIPVPP Project

Location	Expected Effect Attribute				Significant
	Direction	Magnitude	Geographic Extent	Duration	
Construction area	Adverse	Low	Local	Short term	No

Summary

A summary of the key impacts, associated with social and economy for the AR-SIPVPP Project are provided in below. The potential overall impact includes impacts that would arise in the construction phase and in the operational phase of the AR-SIPVPP Project.



Potential Impact	Nature of Impact (Permanent or Temporary) (Direct or Indirect)	Significance (Major, Moderate or Minor) (Positive or Negative)	Mitigation / Enhancement Measures
During the construction and operational phase of the AR-SIPVPP Project is likely to benefit the local economy in terms of the provision of water supply to the Ar Rass area	Permanent	Major Positive	• No Mitigation Measures Required
The potential impacts from the presence of worker, like housing pressure on local area, and resources.	Temporary	Minor Negative	• The assessment has identified the lack of local provisions, in the form of housing, school facilities, because work force which are likely to have families. • It is expected the housing provision for the area will be solved by local business immediately.
The potential impact of the AR-SIPVPP Project operations on social health and safety	Temporary	Minor Negative	• the implementation of appropriate measures as part of the Health, Safety and Environment Management Plan during the operational phase of the plant will ensure that occupational health and safety risks are minimised
Noise	Temporary, Direct	Minor Negative	• Application of best practicable means

Cultural and Historical Values

There are no known cultural or historical values associated within the AR-SIPVPP Project site and it is not expected that any such values would be found. As there are not expected to be any features of archaeological or cultural heritage on or near the AR-SIPVPP Project site, no impacts are expected from the construction of the AR-SIPVPP Project.

13.8 Impacts

Predicted impacts due to construction works of AR-SIPVPP Project on Socio-economic aspects

Summary

A summary of the key impacts, associated with social and economy for the AR-SIPVPP Project are provided in below. The potential overall impact includes impacts that would arise in the construction phase and in the operational phase of the AR-SIPVPP Project.



Table 13.7: Summary of Impacts - AR-SIPVPP Project

Potential Impact	Nature of Impact (Permanent or Temporary) (Direct or Indirect)	Significance (Major, Moderate or Minor) (Positive or Negative)	Mitigation / Enhancement Measures
During the construction and operational phase of the AR-SIPVPP Project is likely to benefit the local economy in terms of the provision of water supply to the Ar Rass area	Permanent	Major Positive	• No Mitigation Measures Required
The potential impacts from the presence of worker, like housing pressure on local area, and resources.	Temporary	Minor Negative	• The assessment has identified the lack of local provisions, in the form of housing, school facilities, because work force which are likely to have families. • It is expected the housing provision for the area will be solved by local business immediately.
The potential impact of the AR-SIPVPP Project operations on social health and safety	Temporary	Minor Negative	• the implementation of appropriate measures as part of the Health, Safety and Environment Management Plan during the operational phase of the plant will ensure that occupational health and safety risks are minimised
Noise	Temporary, Direct	Minor Negative	• Application of best practicable means

Potentially significant issues

- There will be a positive impact from the increased employment creation.

From the available data the baseline conditions were determined both in terms of the current situation and the predicted scenario in the absence of the development. From this, the key sensitive receptors to socioeconomic impacts are shown in table below and were identified as:

- Construction staff will benefit from the employment opportunities offered by the Development of the AR-SIPVPP Project. Their sensitivity is moderate.
- Operational staff will benefit from the employment opportunities offered when the AR-SIPVPP Project restarts operation. Their sensitivity is moderate.
- Increased revenues from better AR-SIPVPP Plant operations



Table 14.8 Sensitive receptors – socio-economic impacts

Receptor	Location	Sensitivity	Likelihood of impacts
Construction staff	On site	Moderate	High
Operation staff	On site	Moderate	High

Predicted socio-economic impacts

Construction

The following potential impacts during the construction stage have been identified:

- ◆ **Noise, air pollution and congestion issues** affecting nearby communities especially the Port staff. The possible impacts are covered in the appropriate sections of this report.
- ◆ **Visual impacts** during construction, including presence of cranes, dredgers and other visually intrusive machinery (covered under the Landscape and Visual section).
- ◆ **Increased employment.** Several jobs will be created during the construction period. The majority of indirect employment is expected to benefit non-local residents (most are likely to be from outside Saudi Arabia). This impact will be beneficial with increased spending in Saudi Arabia, and beneficial economically to the migrant workers and their dependents. The impact will be temporary, lasting only as long as the construction period. Benefits gained by individuals in terms of training and experience will be permanent.

Operation

The following potential impacts during the operation of the scheme have been identified:

Increased job opportunities. Beneficial impact and would affect local residents as well as the wider Ar Rass area. It is very difficult to estimate indirect employment generation in the absence of detailed local economic data

Enhancement to the economy. AR-SIPVPP will bring increased economic activity to Ar Rass area, which will be of benefit to some local businesses and residents and may create new business opportunities servicing users of the new structures. The development will also be of significant benefit to the wider economy of Saudi Arabia. This benefit will be permanent and will have an effect at the local, regional and national level.

Table 13.9- Summary of Impact Assessment

Activity causing impact	Predicted impact	Receptor	Magnitude of impact	Significance of impact
Construction				
Development of AR-SIPVPP Project	Increased employment	Local residents and non-nationals	Moderate (beneficial)	Moderate (beneficial)



Development of AR-SIPVPP Project	Noise, vibration and dust nuisance	Residents and businesses Port staff	Low to negligible (adverse)	Moderate to minor (adverse)
Operation				
Operation of new AR-SIPVPP Project	Increased employment	Local residents and non-nationals	Moderate (beneficial)	Moderate (beneficial)
Operation of AR-SIPVPP Project	Enhancement to the economy to AR-SIPVPP	Local Residents, businesses and the wider Saudi Arabia economy	High (beneficial)	Substantial (beneficial)

During the construction phase there are likely to be some adverse socio-economic impacts as a result of increased noise, dust and visual intrusion. These will be mitigated as far as possible, as set out in the relevant sections of this report.

Overall, the operation of the scheme is anticipated to result in significant beneficial socio-economic impacts resulting from the increase in job opportunities and economic activity in the area. This will benefit local residents, residents of Ar Rass and the national economy.

13.9 Mitigation

Recommended Mitigation measures to mitigate impacts of construction and operation of the AR-SIPVPP Project on Socio-Economic aspects of Ar Rass area

Since the proposed AR-SIPVPP Project Development project has no significant negative impacts and all the impacts are positive in nature. Hence no mitigation measures are recommended: There are significant positive impacts are expected from AR-SIPVPP Project on regional and National scale

13.10 Cumulative Impact Assessment

The IFC PS1 describes “the broader Project area” to include areas potentially impacted by cumulative impacts from further planned development of a project, any existing projects or condition, and other project-related developments that may occur during the life of a project. As was mentioned cumulative impacts are impacts that could act together with other impacts (including those from concurrent and/or planned future third-party activities), resulting in an incremental effect on natural and social resources, social processes and/or socio-economic conditions. Cumulative impacts usually relate to large-scale rather than site-specific impacts and have a tendency to increase the intensity of impacts already predicted for the AR-SIPVPP project.



Table 13-10 Potential Cumulative Impacts

Nature	Direction of change
Improved standard of living through increased employment, local business development and improved public infrastructure and community services and facilities.	Positive
Population influx and urban sprawl, housing backlog and/or growth of informal settlements.	Negative
Added pressure on local public service delivery and infrastructure, including roads, water supply, schools, police services, and waste management facilities.	Negative
Community disruption and impact on social cohesion as a result of population influx, the presence of a non-local workforce, lack of services and facilities.	Negative
The use of non-local labour, due to unavailability of local skilled workers causing tension in local communities as a result of the expectation that the Project should provide local employment.	Negative
Greater competition for natural resources, in particular, and fishing areas.	Negative
Possible increase in poverty in the area due to water scarcity/pollution, greater influx of job seekers and inability of the economy to absorb job seekers or to generate local employment.	Negative
The visual impact of the Project and other similar developments, and associated changes in land use, are significant and imprint an industrial character onto the rural landscape.	Negative
Increased pressure on water resources to maintain the reserves required to supply basic human and ecological needs.	Negative
Compounded effects of lighting, noise, traffic, water and groundwater abstraction and physical reduction in habitat have cumulative impacts on the social and biophysical environment.	Negative

13.11 Conclusion

Following social impacts were identified for the proposed Project, these impacts are summarized in Table 13-11 below.

Table 13-11: Social impacts identified for the proposed AR-SIPVPP-project

Impact	Project phase	Pre-mitigation /Enhancement significance	Post mitigation /Enhancement significance
Employment	Physical construction works; & Construction operations	Minor beneficial	Moderate beneficial
Increased capital expenditure and	Physical construction works;	Negligible beneficial	Moderate beneficial



<i>associated economic effects</i>	& Construction operations		
<i>Workforce requirements and project induced migration</i>	Commence prior to physical construction and is likely to continue after construction operations have been completed.	Minor negative	Negligible negative
<i>Restriction and/or disruption of movement patterns</i>	Physical construction works; & Construction operations	Minor negative	Negligible negative



SECTION 14 WASTE MANAGEMENT



SECTION 14. WASTE MANAGEMENT

14.1 Introduction

This section first establishes the existing waste management baseline. It then identifies potential waste management receptors and highlights likely impacts and effects on these receptors. The chapter also describes the methodology to be used for the waste management impact assessment and presents the results of the assessment

14.2 Scoping

It is anticipated that solid and liquid waste will be generated during Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -CW, which if not appropriately managed have the potential to result in significant effects. The significance of effects pertaining to waste management are determined in this section.

14.3 Legislative Framework

14.3.1 National Standards

The key national legislation in KSA relevant to Waste Management is summarized below.

14.3.1.1 Public Environmental Law, 2001

This is the key KSA environmental legislative statute and sets out the broad regulatory framework under which all environmental standards are set, studies, assessments, investigations, and monitoring activities are undertaken, and all approvals, compliances, and punishments applied. The responsible Government agency for the application of this regulatory framework is the Royal Commission for Jubail and Yanbu and the General Authority of Meteorology & Environmental Protection NCWM / NCEC, (formerly known as the Presidency of Meteorology and Environment, PME).

14.3.1.2 General Environmental Regulations and Rules of Implementation of 2001

The principal law governing environmental protection under NCWM /NCEC statute is the General Environmental Regulations and Rules of Implementation (GERRI) of 2001. This law consists of 24 articles intended to govern NCWM /NCEC objective to prevent harm to the environment and guide relevant parties undertaking activities with potential for adverse environmental impacts. Some of the important aspects dictated by the Law as per Article Two are listed below.

- Preserve, protect and develop the environment and safeguard it from 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, agricultural, architectural and other areas.
- Raise awareness of environmental issues and strengthen individual and collective feelings of the sole and collective responsibility for preserving and improving the environment and encourage national voluntary efforts in this area. Additionally, the law implicates the following.
- Public agencies responsible for the issuance of standards and specifications relating to activities that may impact the environment must coordinate with the NCWM /NCEC before their issuance.
- Parties executing new projects or modifying existing projects must utilize the best possible and most suitable technologies for the local environment and use materials with minimum potential to cause environmental pollution.
- Parties responsible for designing and operating any project or activity should ensure that such projects or activities are in compliance with the applicable regulations and standards.
- Parties engaged in production and servicing to take necessary precautions to achieve the following.
 - Prevent direct or indirect contamination of surface, ground waters that may be caused by solid or liquid residues.

Violations of established environmental criteria and standards will require the concerned agency to coordinate with the NCWM /NCEC and obligate the violator to comply with the following.

- Eliminate and rectify the negative impacts as required by the NCWM/NCEC at a specified time.
- Report to NCWM/NCEC showing steps taken by the violator to prevent future recurrence and must meet the approval from NCWM/NCEC.

In accordance with the GERRI, NCWM /NCEC was charged with the overall responsibility of overseeing and enforcing all environmental affairs in KSA. GAMEP introduced new environmental standards for waste management in 2012 (Ministerial Decision No 8/1/7908 dated 18/4/1433 H, March 11, 2012). The environmental standards for water were updated in 2020, and granted a five-year grace period to correct their status. A summary of the relevant NCWM/NCEC Environmental Standards is presented in Table 14-1.



Table 14-1 NCWM /NCEC Waste Standards

Environmental Standard	Description and Objectives
1. Material Recovery and Recycling of Waste	This standard relates to the recovery and recycling of waste materials, following the internationally recognized waste management 'hierarchy. It aims to assist in minimizing harm and ensuring the protection of the environment, taking account of what is affordable and practicable. It acts as an effective programme to implement best practice initiatives in relation to recovery and recycling of waste materials within KSA extending to commercial, municipal, institutional and industrial wastes.
6. Storage and Material Reclamation Facilities – Design and Operation	The standard is intended for storage and material reclamation facility design and operation. Existing storage and material reclamation facility operators must, as far as practicable, implement the relevant best practice measures contained within this Standard. It regulates waste and hazardous waste in relation to: • design of new storage and material reclamation facilities which accept waste of all types from across the KSA whether a material or substance is inert, non-hazardous or a hazardous waste; and • operation of storage and material reclamation facilities to ensure that the site is managed in a manner which will have least possible impact upon the neighbouring environment or human health.
7. Thermal Treatment and Incineration – Design and Operation	This standard applies to mass burn incineration techniques, waste to energy facilities and the advanced thermal treatment processes of pyrolysis and gasification. It applies to the design of new incineration plants that accept waste from across the KSA whether inert, non-hazardous or hazardous waste, and to the operation of incineration plants to ensure that the sites are managed in a manner which will have a least possible impact upon the neighbouring environment or human health. Existing incineration plant operators must, as far as practicable, implement the relevant best practice measures contained within this standard.
8. Waste Acceptance Criteria	Under this standard acceptance criteria determine waste to be diverted from landfill, or categories of landfill, by establishing contaminant thresholds for hazardous and inert landfills to determine which wastes are acceptable for land filling. Under this standard, hazardous wastes will only be accepted at hazardous waste landfills after it has been treated or stabilized to minimize hazards and then disposed of at landfills that offer an appropriately high standard of environmental protection. The provisions in this standard are relevant to waste destined for disposal at the landfill after consideration of alternative waste management options. This



	standard outlines a nationally consistent approach for KSA for the disposal of waste to landfill.
9. Waste Classification	The objective of this document is to establish a national baseline waste classification system to be utilized by all waste generators, transporters, facility operators and other interested • a classification, coding and defining of all waste types so they can be handled, treated or disposed of accordingly; and • a classification methodology to ensure that waste is dealt with appropriately to ensure the protection of human health and the environment.
12. Waste Regulatory Control and Compliance	This standard establishes the framework to develop and integrate systems for the management of the movement of waste. It aims to assist improved control of environmental pollution, protect public health and welfare and minimize the impact upon economic development. Ensures the assignment of Duty of Care to and registration of waste handlers, provides a framework for tracking and notification systems for hazardous and non-hazardous waste and provides a waste licensing regime for the uniform storage, treatment and disposal facilities. The standard applies to all generators, transporters and facility operators in and extends to all waste types including hazardous, non-hazardous and inert waste across KSA.
13. Waste Handling and Storage	This standard is to ensure the effective handling and storing of waste so as to prevent and minimize spills and leakages that may pose a threat to the environment and/or human health. This standard applies to Waste Handlers who handle and store waste from the point of generation through to the storage of waste where it is held at a facility prior to its onward transfer for recycling, treatment or disposal.
14. Waste Training and Assessment of Technical Competence of Operators	This standard establishes the framework to ensure that efficient, nuisance-free and environmentally acceptable waste management procedures are practiced in KSA by outlining the minimum requirements for training, certification and assessment of persons participating in or responsible for the operation of treatment, storage and disposal facilities. The provisions in this standard are to provide a framework for the Competent Agency on how to carry out the assessment and examination of technical competence of Operators of waste facilities so as to ensure a required level of competence that will protect human health and improve control of environmental pollution. This standard also provides the framework for training carried out by the Competent Agency or an approved training body for waste facility operators in becoming technically competent to a standard capable for assessment by the Competent Agency. The standard extends to all treatment Facilities required to be licensed under the Waste Regulatory Control and Compliance Standard.
15. Waste Transportation	This standard establishes the requirements necessary to ensure that the transportation of waste in KSA is undertaken in a responsible



	manner to safeguard the protection of the environment and the community against potential accidents, spills and pollution. The transport of dangerous goods is regulated in order to prevent, as far as reasonably practicable, accidents to persons or property and damage to the environment, the means of transport employed or to other goods. The transport of dangerous goods within KSA will be aligned, as far as reasonably practicable, with international recognized practice. Additionally, the transboundary movement of waste must be properly monitored and controlled to protect both human health and the environment.
17. Industrial and Municipal Wastewater Discharges	This standard establishes the control of the quality of direct discharges from facilities and persons operating in KSA.
18. Best Practicable Environmental Option for Waste Disposal	Provides a range of waste disposal options, with accompanying advantages and drawbacks, in order to develop uniform waste disposal options that best address KSA's objectives for waste management.
Source: NCWM /NCEC Environmental Standards	

14.3.1.3 Hazardous Wastes

The hazardous waste standards apply to all producers of wastes including various commercial, industrial and vocational institutions, companies and establishments, but do not apply to domestic waste generators. All commercial, industrial and vocational producers of waste are required to adhere to the following (as detailed in the General Environmental Regulations and Rules for Implementation, 2001):

- Confirm with the NCWM /NCEC whether the hazardous waste is generated onsite.
- Refrain from hauling hazardous waste outside the facility until they confirm with the NCWM/NCEC. In the meantime, such waste must be stored in a safe manner, whereby the environment is protected from discharges to the air, water and soil environment.
- The requirements for hazardous waste generators are listed below.
- Based on the review provided for the classification of hazardous wastes, the NCWM /NCEC shall assign an exclusive identification code for the waste generator when it is confirmed that the industry is generating hazardous waste.
- The producer of hazardous wastes shall be required to conduct the following.
 - Ensure a physical, chemical and biological analysis of all wastes is undertaken and a subsequent description of the wastes generated is prepared.
 - Store, treat or dispose of hazardous waste only after obtaining an identification code from NCWM /NCEC.



- Refrain from delivering or allowing a hazardous waste transporter or a facility that does not have a license to operate from the NCWM /NCEC
- Refrain from delivering any consignment of hazardous waste for transportation outside the facility without being accompanied by an approved transportation document.
- A hazardous waste generator who stores hazardous wastes at the site where the wastes are generated for more than three months shall be deemed as an operator of a storage facility and shall be required to comply with the standards for hazardous waste management facilities

14.3.2 International Standards

14.3.2.1 Basel Convention

KSA has ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. KSA ratified the Basel Convention on 07 March 1990.

The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as “hazardous wastes” based on their origin and/ or composition and their characteristics, as well as two types of wastes defined as “other wastes”.

The provisions of the Convention are based on the following aims.

- The reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal.
- The restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management.
- A regulatory system applying to cases where transboundary movements are permissible. Under the Basel Convention, all trans-frontier shipments of waste must be approved by the competent authorities in the consigning and receiving countries. The competent authority for Saudi Arabia is the General Authority of Meteorology and Environment Protection.

14.3.2.2 WBG/IFC

PS1 Assessment and Management of Environmental and Social Risks and Impacts - Underscores the importance of identifying environmental and social risks and impacts and managing environmental and social performance throughout the life of a project. Particularly relevant is GN27 and GN28 of IFC PS1, where it is acknowledged that projects can include specific activities with limited adverse environmental and social risks and / or impacts, for which a full scale ESIA would not be required by



the host country regulation, and where instead a limited or focused environmental and social assessment could suffice. PS3 Resource Efficiency and Pollution Prevention – defines an approach to pollution prevention and abatement in line with current internationally disseminated technologies and good practice. Recognizes that increased industrial activity and urbanization often generate higher levels of air, water, and land pollution and that there are efficiency opportunities.

14.4 Spatial and Temporal Boundaries

In the context of waste, the project area of influence is the site level for construction workers and neighboring land-users (existing and future).

14.5 Baseline Methodology

14.5.1 Introduction

This waste management assessment is set against the existing (baseline) conditions at the site.

14.5.2 Baseline Data Collection Methods

The Waste Management baseline for the CW has been developed through a combination of literature review and site reconnaissance.

14.6 Baseline Characteristics

It is generally acknowledged that solid Waste in KSA is historically poorly managed while good quality waste management infrastructure or facilities are limited, especially at locations away from major cities, such as the current Project area. Typically, waste management infrastructure in KSA is in a state of development with a low level of capture of generated waste to facilities other than landfills. KSA generates between 1-1.49 kg/capita/day of waste. Waste production is projected to increase year on- year. Based on a detailed waste characterization undertaken in 2014, the split of municipal solid waste (MSW) is shown in Table 14-3.

Table 14-3 Municipal Solid Waste Characterization for KSA

Description	Composition (%)
Putrescible	57.2
Paper	7.0
Card	4.6
Dense plastic	6.4
Plastic film	6.6
Ferrous metal	1.7
Non-ferrous	0.6
Glass	3.0
Composites	0.6
Textiles	2.9
Unclassified incombustibles	1.3



Combustibles	6.6
WEEE	0.4
Hazardous household waste	0.2
Liquids	0.9

14.7 Impact Assessment and Mitigation

The identification of environmental and social aspects associated with the Project and the receptors that may be potentially affected has been used to identify potential waste impacts and effects during the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), -CW, these are:

- WM1 - Effects on AR-SIPVPP Waste Management Infrastructure (the capacity of the existing waste infrastructure to accommodate the additional waste generated) during AR-SIPVPP -CW

14.7.1 Impact Assessment Methodology

The waste study methodology comprises the following steps:

- Estimate the types of quantities of waste likely to be generated by the Project.
- Identify the potential management route for each waste stream.
- Identify appropriate mitigation measures for the handling, temporary storage, and transport of waste.
- Assess any residual impacts based on consideration of waste types and the suitability of the available waste management facilities. The National Environmental Standards (NES) set out, in detail, many of the key principles for waste management (e.g., waste hierarchy, proximity principle and duty of care) and provide clear guidelines for managing waste in a manner which protects human health and the environment which will be designed as embedded mitigation measures into the Project. These include waste acceptance, classification, and tracking system (a requirement of NES 862 **Invalid source specified.**, 963 **Invalid sources specified.** and 1264 **Invalid source specified.**) and the principles of the waste hierarchy, proximity principle and best practicable environmental option (BPEO) and duty of care (as required by NES 1865 **Invalid source specified.**). The magnitude of the impacts for each waste stream is assessed based on the:
 - Volume and hazardous properties of wastes produced.
 - Capacity of identified waste management facilities for managing the waste in compliance with relevant guidelines.
 - Degree of certainty regarding the availability of these facilities. Table 14-4 outlines the impact assessment criteria used for the various categories of waste, according to the proposed method



of managing that waste type. As part of SOW of ACWA - AR-SIPVPP, new waste management facilities will be developed. In the impact assessment, these new waste facilities will be assessed as mitigation measures: the impacts of waste from the Proposed AR-SIPVPP Development will be assessed considering these facilities as embedded mitigation measures

Table 14-4 Waste Management Impact Magnitude Criteria
Management Route for AR-SIPVPP Project Waste

	Type of Waste		
	Inert	Non-hazardous	Hazardous
Suitable facilities available with sufficient capacity to manage the quantities of wastes generated	Negligible	Negligible	Low
Suitable facilities available but capacity to accept waste from project may be constrained due to size of facility or distance from site	Low	Medium	Medium
Facilities are unavailable or unsuitable; or means of management is uncertain.	Medium	Medium	High

14.7.2 Effect Significance

The waste impact criteria recognize that the highest potential effects would be associated with managing hazardous wastes where suitable facilities are either not available or have not been identified. Suitable facilities are those which are licensed by the relevant regulatory authorities and are operating in accordance with GIIP. Using this approach, the significance of the effect is based on the magnitude of impact, with **moderate** and **high** magnitude impacts being deemed significant; although professional judgment is used in some cases to further define whether or not effects are significantly based on a more detailed consideration of specific waste types and quantities.

14.7.3 Mitigation

AR-SIPVPP project will aim to set a new sustainable development standard through:

- The Developer is establishing a waste management facility for the Development;
- 100% renewable energy under normal operations;
- New zero carbon development;
- All organic waste to be used for agriculture; 62 Presidency of Meteorology and Environment (PME/ GAMEP/NCEC). (2012). Kingdom of Saudi Arabia National Environmental Standard No. 8 - Waste Acceptance Criteria 63 Presidency of Meteorology and Environment (PME/GAMEP). (2012). Kingdom of Saudi Arabia National Environmental Standard No. 9.



Waste Classification 64 Presidency of Meteorology and Environment (PME/ GAMEP/NCEC). (2012). Kingdom of Saudi Arabia National Environmental Standard No. 12. Waste Regulatory Control and Compliance 65 Presidency of Meteorology and Environment (PME/ GAMEP/NCEC). (2012). Kingdom of Saudi Arabia National Environmental Standard No. 18. Best Practicable Environmental Option for Waste Disposal

- 100% biodegradable plastic to be used; and
- Modular construction techniques used for the EW. To assist in reaching these aspirational project objectives it is critical to embed overarching sustainability themes within the design development. The sustainability themes set out a series of high-level objectives and guidance on the key development priorities related to sustainability. These themes include:
 - **Resource Efficiency** – minimize consumption of resources (energy, water materials, and waste).
 - **Waste** - will be appropriately separated and stored at the initial site compounds prior to transfer to appropriate disposal facilities offsite.

14.7.3 Demand on existing waste management infrastructure

The wastes produced during the construction phase will be predominantly inert or non-hazardous and only a relatively small amount of hazardous waste will be generated. The main construction activities contributing to waste generation include:

- Construction of buildings and supporting infrastructure;
- Temporary workshops;
- Maintenance areas for construction machinery and equipment;
- Fuel and chemicals storages;
- Construction site offices; and
- Workers' rest areas. Smaller quantities of hazardous wastes such as paints, oils, adhesives, and fillers will be produced as waste together with the containers in which they were delivered. Additionally, the equipment used on the site will require day-to-day maintenance and re-fueling. Spare-parts, discarded equipment, and fuel storage containers may also constitute hazardous wastes. Wastewater or sewage will be generated from offices, and residences at the site and will be temporarily collected in sewage holding tanks, prior to removal and disposal to an off-site STP.

14.7.4 Summary of Waste Management effects - Demand on waste management infrastructure



Waste volumes are not large, indicates a large portion of the produced waste would be suitable for landfill diversion through recycling, recovery or reuse. The project developer will need to coordinate with waste management facilities to ensure there is capacity within the existing waste management infrastructure to assimilate the existing waste until AR-SIPVPP waste infrastructure is established. It is assessed that Project Design and implementation of GIIP will mitigate waste nuisance (odour, littering or attraction of vermin) or workers health issues as a result of waste management and are not considered further.

Additional mitigation measures:

- A dedicated waste management facility should be established. This will occur prior to the start of works on the development and be documented in the Waste Management Plan and in the Construction Environmental Social Management Plan (CESMP).
- Preparation of a Waste Management Plan as part of the CESMP and the Operational Environment Social Management Plan (OSEMP) to detail implementation plans for managing operation related wastes. The Waste Management Plan will address include good practice and GIIP in relation to mitigate waste nuisance (odour, littering or attraction of vermin) or workers health issues.
- All clean cut and fill material used within the site (subject to meeting engineering verification for use) is not to be considered as waste but should be captured in the waste volume that has been designed out.
- Use of pre-fabricated buildings units will involve less civil construction and is expected to use less energy during construction, generate less construction waste and minimize noise pollution on site
- Monitor and record waste production in order to put waste management and waste reduction KPI/targets in place
- Waste will be segregated according to their composition, source, and type at source and contained in appropriately labelled and/or color-coded waste containers or waste skips. These bins will be located at all active work areas where waste is generated and will make provision for the sorting of solid waste. Wastes must be segregated according to the following streams (it is anticipated that at a minimum waste will be segregated into recyclables, organics and residuals):
 - Wood/timber Concrete Metal/Steel Foo /perishables



- Other recyclables including paper and plastic
 - Waste oil
 - Biomedical waste
 - Oil-soaked waste including gloves and filters
 - Other hazardous waste
 - Excavation spoil
 - General waste (i.e., not covered by any categories above).
- All food waste bins must be placed in skips or bins with lids that are kept closed when not in use and emptied daily to avoid pests and scavengers. All work sites must be free of discarded food wastes or other putrescible wastes. All organic waste should be safely processed and used in local agriculture or landscaping, especially during construction and AR-SIPVPP -CW before waste management networks become established.
- All waste will be handled in accordance with its class (hazardous or non-hazardous) and all personnel collecting, handling, transporting or disposing of waste will be trained in the proper procedures for dealing with the said waste class.
- To promote “4Rs” (Reduce, Reuse, Recycle and Reclaim) waste management concept, all waste will be sorted and managed as appropriate, either for reuse, recycling or disposal. This is to include toolbox talks with workers and staff to raise awareness and promote a culture of absolutely no littering. This is to include toolbox talks with workers and staff to raise awareness and promote a culture of absolutely no littering and will be included in both CESMP and OESMP.
- Ensure contracts are in place with approved waste service providers including recycling companies
- Waste to be disposed of at appropriate and licensed facilities in accordance with ACWA Power Company (Saudi Listed Joint Stock Company) Waste policies and that have been approved by ACWA Power Company (Saudi Listed Joint Stock Company) and the local authority
- Transport vehicles will cater to the type, class, and quantity of waste being transported in terms of its composition, load capacity, covering, etc.
- The waste manifest must be kept on record for auditing purposes, including proof of waste generated, reused, recycled and disposed of, including disposal certificates, including quantities and type of hazardous waste generated.



- No littering or unauthorized dumping of any types of wastes or burial of wastes must be undertaken at the site or anywhere else.
- No build-up / accumulation of waste permitted on construction sites - designated areas must be provided for solid municipal waste and daily collection and period disposal must be ensured
- In case of accidental spillage, contaminated soil must be immediately removed and stored prior to disposal as hazardous waste
- Any temporary sewage holding tanks (including underground tank) must be built in such a way that visual monitoring of the area surrounding the tank is possible to check for any leak or damage. The use of temporary holding tanks must be kept to the minimum required and maximum use made of permanent/long-term Sewage Treatment Plant
- Hazardous liquid wastes such as used lubricating oil will be collected and stored only at dedicated area with secondary containment
- Promotion of a culture of waste avoidance, minimization, reuse, recycle and/or appropriate disposal.
- Ensure a dedicated waste management area is made available on-site with suitable identification for the segregation and storage of the different waste types generated.
- Implementation of waste recycling options for materials, such as paper, cardboard, metals, and plastics.
- Secure off-take agreement with suppliers (for excess stock).
- It is noted that the Project design has not proposed an interim waste solution for assessment but it is anticipated a temporary waste holding facility will be required, considering the limited existing regional waste management options.

14.8 Cumulative Impact Assessment

The cumulative effect of the M/S ACWA Power Company (Saudi Listed Joint Stock Company) Project with other developments in the Project Area, have the potential to cause significant negative impacts on the demand for waste infrastructure. It is anticipated that a waste management policy will be required to address the management of waste outputs from these projects.



SECTION 15. ARCHAEOLOGY AND CULTURAL HERITAGE



SECTION 15. ARCHAEOLOGY AND CULTURAL HERITAGE

15.1 Introduction

This section presents an assessment of the potential impacts on archaeology and cultural heritage associated with Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -CW and includes the construction of access tracks/haul roads, ground leveling and construction of workers accommodation and compounds. Full details of the AR-SIPVPP -CW are detailed in Section 3. Cultural heritage is an important component of the cultural identity of communities, groups and individuals, and of social cohesion (UNESCO 2003). Cultural heritage is defined as artifacts, monuments, buildings and sites that have a diversity of values including symbolic, historic, artistic, aesthetic, ethnological or anthropological, religious, scientific and social significance (UNESCO 1972). Cultural heritage includes tangible cultural heritage (movable and immovable cultural heritage), intangible or living cultural heritage; and natural heritage. The scope of the archaeology and cultural heritage (ACH) baseline studies follows the definition set out in IFC PS 8 Cultural Heritage (2012, para. 3).

Its scope includes:

- Tangible cultural heritage with archaeological, paleontological, historical, cultural, artistic, and religious values;
- Unique natural features or tangible objects that embody cultural values, such as sacred groves, sacred trees, rocks, lakes, and waterfalls;
- Intangible forms of culture proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles; and
- Critical cultural heritage; internationally recognized or legally protected cultural heritage areas, including proposed World Heritage Sites. Heritage of communities who use or have used within living memory the cultural heritage for long-standing cultural purposes. In order to facilitate the assessment of these potential impacts, this chapter provides a description of the legislation and policy framework, assessment methodology, baseline conditions at the site and its surroundings, assessment of the Project impacts and the mitigation measures required to avoid, reduce or offset any significant adverse effects, and the likely residual effects after these measures have been employed. The likely potential for cumulative impacts, when considered along with other schemes in the surrounding area, is also discussed. The Project has been designed to avoid impacts on cultural heritage where feasible while balancing cultural heritage considerations with



other environmental, social and engineering requirements. Where there is uncertainty and where significant cultural heritage impacts remain, this chapter also presents suitable mitigation measures which aim to minimize predicted impacts.

15.2 Scoping

AR-SIPVPP will situate in an undeveloped area. There are no Places of Archeological and cultural interest are existed. Keeping in view of this, there might be possibility of Archeological and cultural places may be found during construction phase. Hence this topic was proposed to focus.

- Potential direct and indirect impacts on designated and non-designated historical and heritage assets and their setting, resulting in damage and reduced aesthetic value of assets.
- Potential impacts on archaeological features (unknown). These impacts would be caused by site preparation and construction activities, including in particular disturbance of previously undisturbed land.
- Potential indirect impacts on cultural sites, resulting in the disturbance. These impacts would be caused by site construction activities with the potential to cause noise and vibration, reduce visual aesthetics, restrict access for religious ceremonies, breach traditional religious norms and alter practices, and affect the tranquility and significance of the sites.

15.3 Legislative Framework

Standards and legislation applicable to archaeology and cultural heritage are divided into two (2) subsections, namely:

- National: Saudi Arabian legislative and regulatory framework, and international protocols/agreements/treaties to which KSA is a party.
- International: International policies, standards and guidelines including IFC PS and EHS Guidelines, and Good International Industry Practice (GIIP).

15.3.1 National Legislative Context

A summary of the applicable Saudi Arabian cultural heritage legislation is presented in Table 15-1. Cultural heritage is protected in the 2014 Antiquities, Museums and Architectural Heritage Law, which as stated in its article 92 supersedes the Antiquities Law promulgated by Royal Decree No. M/26, repealing any conflicting provisions. Chapter 1 of the 2014 Antiquities, Museums and Architectural Heritage Law provides explanations and definitions of organizations and terms referred to within the Law and sets out general provisions. Article 9 of the said chapter refers to encountered heritage within development programmers', stating 'Archaeological⁶⁶ and urban⁶⁷ heritage sites shall be preserved when carrying out projects for planning, expansion or



improvement of urban or rural areas. 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' (Article 9, 2). The determination of an archaeological and urban heritage site is to be made by the SCTA, coordinating with the Ministry of Municipal and Rural Affairs and relevant agencies, each within their jurisdiction (Article 9,1). The provision continues 'Licenses for construction or renovation in areas adjacent to archaeological and urban heritage sites may not be issued without SCTA's agreement' (Article 9, 3). Chapter 2 of the 2014 Law outlines the provision for archaeological, historical and folk heritage sites. This includes the stipulation that archaeological and urban heritage sites may not be altered, 'the debris found thereat may not be used; and soil, rocks or any other material may not be removed there from without the permission and supervision of SCTA' (Article 22). Article 24 states that the following activities may not occur within the limits of archaeological and urban heritage sites without the prior approval of SCTA:

Table 15-1 National Legislation, Standards and Guidelines Applicable to the Archaeology and Culture Heritage

Law / Act / Regulation	Objective
Royal House of Saudi Arabia Constitution or Basic Law of Governance No A/90 27/8/1412 [Hegira calendar] (1992)	'The State shall foster sciences, arts and culture. It shall encourage scientific research, shall preserve Arab and Islamic heritage and shall contribute to Arab, Islamic and human civilization'. (Article 29 of the Basic Law)
Antiquities, Museums and Architectural Heritage Law (2014)	To enshrine the protection of cultural heritage in Law. The Law supersedes the Antiquities Law promulgated by Royal Decree No. M/26, repealing any conflicting provisions
Register of Investment for Archaeological and Heritage Sites and Buildings and the Operation of Sites for Visitor Services in Archaeological and Heritage Sites and Museums (2014)	Guidance for implementing the 2014 law.
Statutes of the Saudi Commission for Tourism and Antiquities (2000)	Approval of the establishment of Supreme Commission for Tourism (SCT), which subsequently develops into the Saudi Commission for Tourism and Antiquities (SCTA), integrating the Antiquities and Museums Agency, and then into the Saudi Commission for Tourism and National Heritage (SCTH).
Antiquities Law no M/26 on 23/6/1392 [Hegira calendar]. Royal Decree (1972)	To enshrine the protection of cultural heritage in Law, including the establishment of the Supreme Council for Antiquities. The laws stipulated therein are superseded by the 2014 Antiquities, Museums and Architectural Heritage Law.
Cooperation criteria between Saudi institutions on Antiquities Legislation (1972)	-----
Religious law (esp. re. graves/grave relocation)	-----



Relevant international and regional protocols/agreements/treaties to which KSA is party are set out in Table 15-2.

Table 15-2 International Environmental and Social Agreements of Relevance to Archaeology and Cultural Heritage

Agreement/ Convention	Objective	Relevance to Project	Date of ratification / accession by Saudi Arabia
Convention and First Protocol for the Protection of Cultural Property in the Event of Armed Conflict (Hague Convention) 1954	Sparing cultural heritage from consequences of possible armed conflicts by peacetime safeguarding measures and refraining from any act of hostility directed against cultural property. Registering immovable cultural property of very great importance in the International Register of Cultural Property under Special Protection.	Relevant to status of KSA WH property	20/01/1971
UNESCO 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (Convention on Cultural Property)	Prohibits and prevents the illicit import, export and transfer of ownership of cultural property and aims to discourage the pillage of archaeological sites and cultural heritage by controlling international trade in looted antiquities through import controls and other measures.	Ensure that Project staff do not loot objects themselves, or purchase and attempt to export any looted objects.	08/09/1976
UNESCO 1972 Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention)	To ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage on states' territories.	Ensure consideration and protection of World Heritage, including KSA WH property	07/08/1978
UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage	To ensure and strengthen the protection of underwater cultural heritage for the benefit of humanity, with a preference for preservation in situ.	Ensure consideration and protection of World Heritage, including KSA WH property	13/11/2015
UNESCO 2003 Convention for the Safeguarding of the	To safeguard and ensure respect for the world's Intangible Cultural Heritage,	Ensure consideration and protection of Intangible Cultural	10/01/2008



Intangible Cultural Heritage	including raising awareness of the importance of intangible heritage and encouraging international cooperation and assistance.	Heritage, including local languages, ceremonies and lifeways.	
UNESCO 2005 Convention on the Protection and Promotion of the Diversity of Cultural Expressions	Recognizes the rights of states to protect and promote the diversity of cultural expressions, encompassing cultural and natural heritage, movable cultural property, intangible cultural heritage and contemporary creativity.	Mindfulness that cultural expression is an area of conflict.	Not ratified

15.3.2 National Standards and Guidance

The SCTH provides guidance on ‘archaeological regulation’.

15.3.3 International Standards and Guidelines

Where KSA legislation does not provide standards and guidance for a given aspect, or where international criteria are more stringent than the KSA equivalent, international standards will be adopted. International standards and guidelines of relevance to the archaeology and cultural heritage study are outlined in Table 15-3.

Table 15-3 International Standards and Guidelines Application Archaeology and Cultural Heritage

Standard/ Guideline	Objective	Relevance to Project
UNESCO 1956 Recommendation on International Principles Applicable to Archaeological Excavations (New Delhi)	To ensure the protection of its archaeological heritage, the provision of archaeological services, the control over accidental discoveries and the upkeep of excavation sites and monuments, the establishment of museums and public education, and the repression of clandestine excavations and of the illicit export of archaeological finds.	Informs the principles of field survey and mitigation measures.

15.4 Spatial and Temporal Boundaries

15.4.1 Project Area of Influence and Study Areas

The archaeology and cultural heritage study area are defined as including the Project area plus a buffer of 200m from the terrestrial footprint, which is subject to limited tidal ranges and erosive wave action.



15.5 Baseline Methodology

Methods: Field survey method and Desk top study

The aim of the desk-based assessment is to determine, as far as is reasonably possible from existing records, the nature, extent and significance of the archaeological remains and cultural heritage within the Study Area. The desk-based assessment describes the historical development of the Study Area and the wider area, placing it in context in order to predict its ACH potential;

15.6. Archaeology

15.6.1. Critical Cultural Heritage

Critical cultural heritage consists of one or both of the following types of cultural heritage: (i) the internationally recognized heritage of communities who use, or have used within living memory, their cultural heritage for longstanding cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation (IFC PS8 2012). **Internationally Recognized Cultural Heritage Areas** The study area does not contain any World Heritage Sites.

Saudi Arabia has five cultural sites inscribed on the World Heritage List⁷³:

- Al-Hijr Archaeological Site (Madâin Sâlih) (2008; WHS Ref. 1293);
- At-Turaif District in ad-Dir'iyah (2010; WHS Ref. 1329);
- Historic Jeddah, the Gate to Makkah (2014; WHS Ref. 1361);
- Rock Art in the Hail Region of Saudi Arabia (2015; WHS Ref. 1472; and
- Al-Ahsa Oasis, an Evolving Cultural Landscape (2018; WHS Ref. 1563).

Table 15-5 Archaeology and Cultural Heritage Impact Magnitude Criteria

Magnitude	Description
High	Changes to most or all key archaeological sites such that the resource is totally altered. Changes to key architectural and artistic building elements such that the resource is totally altered. Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit. Comprehensive changes to setting. Major changes to an area affecting intangible cultural heritage activities, associations, visual links and cultural appreciation.
Moderate	Changes to many key materials of archaeological sites, such that the resource is clearly modified. Changes to setting that affect the character of the asset. Changes to many key historic building elements, or to the setting of an historic



	building, such that the resource is significantly modified. Change to many key historic landscape elements, parcels or components; visual change to many key aspects of the historic landscape; noticeable differences in noise or sound quality; considerable changes to use or access; resulting in moderate changes to historic landscape character. Considerable changes to an area affecting intangible cultural heritage activities, associations, visual links and cultural appreciation.
Low	Minor changes to key archaeological sites, such that the resource is slightly altered or clearly modified. Slight changes to setting, or changes to setting that affect the character of the asset. Slight changes to the setting of key historic building structures. Changes to many key historic building structures, or to the setting of an historic building, such that the resource is slightly different and noticeably changed. Change to many key historic landscape elements, parcels or components; slight or minor visual change to many key aspects of the historic landscape; limited but noticeable differences in noise or sound quality; changes to use or access; resulting in limited to minor changes to historic landscape character. Minor changes to area that affect intangible cultural heritage activities, associations, visual links and cultural appreciation.
Negligible	Very minor or no changes to archaeological asset, historic building fabric or setting. Very minor or no changes to elements, parcels or components of landscapes; no visual or audible changes. Very minor or no changes in amenity or community factors.

15.7 Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Archeology and Cultural Places

Al Shinanah Historical Tower

Ar Rass, Saudi Arabia

This tower has survived the times despite being composed of mud and camel hair.





About 217 miles (350 kilometers) northwest of Riyadh, Ar Rass is the largest urban center in Al-Qassim Province by size and third-largest by population. Ar Rass (الرس) translates to “old well,” and refers to the source of water that made it possible for people to settle in this area. It also made the area one of the most important trades and pilgrimage routes. At first sight, Ar Rass is nothing more than a cluster of modern buildings surrounded by the desert, but its history dates back to settlements like this and the Al Shinanah Tower.

Located on the southwestern edge of town, Al Shinanah Tower has a truncated conical shape measuring 88.5 feet in height, 20 feet in diameter at the base, and five feet at the top. Its interior is divided into eight floors, which can be accessed through a low, narrow door at the base. There are three windows on different floors.

Constructed in 1699 using mud and camel hair, Al Shinanah Tower is an outstanding example of Qassim architecture. It was built as a watchtower, which explains why it is located on a slightly elevated plain.

The tower played a role in numerous intertribal skirmishes, but also in battles between Ottomans and Arabs. The most recent use of the tower as a military outpost dates back to the Battle of Shinanah (1904) when Rashidi and Saudi forces clashed in the Qassim Province. It is, therefore, quite surprising that this structure survived to this day, especially considering its slender shape.



Al Shinanah Tower is now fenced in, but the gates are open for most of the day. Within the perimeter of the compound are also a mosque, an administration office, and a semi-permanent tent where the custodian can be found.





The city of Ar Rass is one of the most important tourist cities in Saudi Arabia, which has a picturesque nature and a rich history and is full of events that have been imprinted on many important archaeological and heritage sites that achieve the highest rates of tourism attraction in Ar Rass and the Kingdom in general.

The most important tourist places in Saudi Arabia

The Saudi city of Ar Rass includes a number of important archaeological sites, some of which date back to ancient times in the history of the city and the Kingdom, such as the period of the Ottoman occuAl Bahahn and the establishment of the Saudi state and much earlier, and perhaps one of the most important tourist attractions in Ar Rass is what we saved for you.

Shananah ruins

It is the ruins of an ancient village that was located southwest of the city of Ar Rass in ancient times in the history of the Kingdom of Saudi Arabia. The ancient village may have melted due to the successive wars that Ar Rass witnessed before declaring a part of the Kingdom of Saudi Arabia clearly and more explicitly than the influence of time factors on it. The Shananah ruins are among the attractions of tourism in Ar Rass between the local residents and the foreign tourists who come to see



the old village houses, mosques and irrigation wells that were used by the ancient residents and the surrounding beautiful scenery that captivates the eyes.



Shanana Tower

One of the most important tourist places in Ar Rass that you can pass through and visit during your visit to the ruins of Al-Shanana, which is a watch and reconnaissance tower dating back to the twelfth century AH that was restored twice in the first in 1980, and the second in 2002 when it was surrounded by a stone wall, and the tower was built of clay in the form of conical The shape is 14 storeys high or 27 meters height

Ibrahim Pasha's tunnel

One of the most important historical monuments that attract the attention of tourists during tourism in Ar Rass, the tunnel that has been left to develop since the thirties of the nineteenth century tells the story of the struggle of the people of Ar Rass Saudi Arabia against the Ottoman siege imposed on them by the Ottoman governor Ibrahim Pasha for a period of 4 months, which ended in digging this tunnel, which extends for a distance of 180 M under the ground was stuffed with gunpowder in an attempt by his army to storm the Ras, but the tunnel exploded after they were shot by the people of the city, and the tunnel is located south of King Faisal Street in the old city.



Grandparents' House

It is a private, non-governmental museum that takes the form of the popular houses that distinguished the ancient city of Ar Rass Saudi Arabia, and aims to show the social life of the city's residents in the past centuries through its valuable and elegant heritage collections such as coffee makers, coffee and grain milling, agricultural tools, kitchen tools, Clothing, jewelry and traditional jewelry for the women of the city, and in front of the antique heritage house lined with a group of precious antique cars.

The ancestral home is one of the attractions of tourism in Ar Rass for young people of the city and the Kingdom before foreign tourists to know what they may not know about the ancient history of their country.





The compartment of the Prince door

It is among the tourist places in the Saudi city of Ar Rass, the most distinctive because it represents the remains of the wall of the ancient city of Ar Rass, which the army of the Ottoman Governor Ibrahim Pasha failed to storm despite the use of weapons, shells, and the military and economic blockade of the city for 4 months, and the cabin is located next to the house of the late former Prince Al-Assaf Al-Hussein in the east of the city.



Jadiah Heritage Castle

It is a new heritage castle that bears the name of the city and the family that it established in 2007 on an area of 6250 square meters, which can accommodate spacious rooms and halls that include thousands of pieces and antique holdings of up to 20,000 pieces of coins, kitchen appliances, weapons, and antique heritage clothing, in addition to a popular market that attracts the attention of About one million tourists annually.



Martyrs' Cemetery

One of the most important tourist places in Ar Rass and most sacred historical for the indigenous people, the cemetery now contains the remains of 59 men and 11 women from the martyrs of the Ottoman siege of the city of Ar Rass Saudi Arabia during the 19th century, at the beginning the cemetery was walled by a mud wall that was surrounded by another stone wall in 1982 in order to protect it as a teacher Historic and important heritage.



There places are far away from Ar Rass Solar Parks and no impacts are anticipated during the construction and operation .Hence no mitigation is required



SECTION 16. CLIMATE CHANGE AND GREENHOUSE GASES



SECTION 16. CLIMATE CHANGE AND GREENHOUSE GASES

16.1 Introduction

This chapter describes the assessment outcomes of the potential impacts of the Project on the climate and its contribution of greenhouse gases (GHG) to the atmosphere. The scope of the assessment of impacts is defined in section 5 ESIA Methodology concluding the following impacts are scoped in for assessment:

Construction Phase:

- GHG from on-site power generators, heavy machinery and vehicle/vessel movement
- GHG from embodied carbon through material extraction and manufacturing processes

Operational Phase:

- GHG from vehicle/vessel movements
- GHG from wastewater treatment and water supply
- GHG from waste management

GHG from maintenance of buildings and infrastructure assets

- Impacts to the Project power by climate change

In line with the IEMA guidance (2015 and 2017); this assessment looks at the Lifecycle greenhouse gas (GHG) impact - the impact of GHG emissions arising from the Project on the climate during the lifecycle stages within the scope of the assessment

16.2 Legislative Framework

This section outlines the international and national standards relevant to the climate change assessment. These standards and guidelines have been used to identify appropriate methodologies, receptors, environmental impacts and relevant mitigation measure.

16.2.1 International Standards

16.2.1.1. The Equator Principles Version 4 (EP4)

The Equator Principles (EPs) are a risk management framework adopted by financial institutions for determining, assessing and managing environmental and social risk in projects. Currently, over 100 EP Financial Institutions (EPFIs) in 38 countries have officially adopted the EPs. The effective date for EP4 on all mandated transactions will be 1 July 2020 (Equator Principles, 2020).

The EPFIs will only provide financing to projects that meet the relevant requirements of Principles 1 to 10. The requirements of the Principles of direct relevance to the Project are described below:



- P2 – Environmental and Social Assessment – Category A and, as appropriate, Category B projects⁵³, as defined using the IFC environmental and social categorization process (IFC, 2020), will be required to undertake an environmental and social risk assessment, the documentation of which must include an ESIA.
 - *A Climate Change Risk Assessment is also required for “all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of carbon dioxide equivalent (tCO₂e) annually. Consideration must be given to relevant Climate Transition Risks (as defined by the TCFD⁵⁴) and an alternatives analysis completed which evaluates lower Greenhouse Gas (GHG) intensive alternatives.”*

(According to the EP4, “there can be a range in the scale of potential environmental and social risks and impacts within Projects classified as Category B. In general terms, higher risk Category B Projects will be treated similarly to Category A Projects, and lower risk Category B Projects could be treated in a lighter regime. The EPFI shall, at their own discretion, determine the appropriate level of Assessment Documentation, review, and/or monitoring required to address these risks and impacts in accordance with Principles 1-10.”)

- P4 - Environmental and Social Management System and Equator Principles Action Plan - For all Category A and Category B Projects, the EPFI will require the development of an Environmental and Social Management System (ESMS) and of an Environmental and Social Management Plan (ESMP) to address issues raised in the assessment process, incorporating actions required to comply with the applicable standards.

16.2.1.2 Paris Agreement

The central aim of the Paris Agreement, published by the United Nations Framework Convention on Climate Change (UNFCCC), is to facilitate a global response to the threat of climate change and to keep global temperature rise this century well below 2°C above pre-industrial levels (UNFCCC, 2015). A more ambitious aim within the Paris Agreement includes limiting the temperature increase even further to 1.5°C.

16.2.1.3 Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance

In the absence of any widely accepted guidance on assessing the significance of the impact of GHG emissions, guidance published by IEMA in 2017 has been followed as it provides a framework for



taking GHG emissions into account in the ESIA process (IEMA, 2017), in line with the 2014 European Union (EU) Directive (Directive 2014/52/EU; European Union, 2014). The guidance sets out how to:

- Identify the GHG emissions baseline in terms of current and future emissions;
- Identify key contributing GHG sources and establish the scope and methodology of the assessment;
- Assess the impact of potential GHG emissions and evaluate their significance; and
- Consider mitigation in accordance with the hierarchy for managing project related GHG emissions - avoid, reduce, substitute, and compensate.

16.2.1.4 Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation

IEMA guidance has also been followed as it provides guidance for taking the impacts of climate change in to account within the project design (IEMA, 2015). The guidance sets out how to:

- Define climate change concerns and environmental receptors vulnerable to climate factors;
- Define the environmental baseline with changing future climate parameters; and
- Determine the resilience of project design and define appropriate mitigation measures to increase resilience.

16.2.2 National Standards

16.2.2.1 Saudi Vision 2030

The Saudi Vision 2030 highlights the importance of moving towards a greater uptake of renewable energy production and use and outlines an initial target of generating 9.5 gigawatts of renewable energy by 2030 (KSA, 2016a).

16.3 Spatial and Temporal Boundaries

The spatial study area covers direct GHG emissions arising from activities undertaken within the Project boundary during the construction and operation of the Project. It also includes indirect embodied emissions within construction materials, arising as a result of the energy used for their production, including extraction, processing, manufacture and transportation.

The temporal study period is the next 60 years up to 2080. However, no emissions inventory projections or Paris Agreement targets are available beyond 2050 within the Climate Action Tracker (Climate Action Tracker, 2019).

16.4 Baseline



This section describes the baseline environmental characteristics for the Project and surrounding environment with specific reference to GHG emissions and climatic conditions.

16.4.1 Lifecycle GHG Impact Assessment

This is a business as usual, or ‘do-nothing’ scenario, whereby the Project is not consented, for those lifecycle stages within the scope of the assessment, outlined in section 16.7.1. The quantity of GHG emissions would, therefore, remain unchanged from the current level.

As the current land use of the site is undeveloped land, and there is currently no consented development within the site boundary, the baseline emissions for the lifecycle GHG impact assessment are zero.

16.5 Receptors

Based on a review of the baseline conditions, the global climate is the receptor for the lifecycle GHG impact assessment. The sensitivity of this receptor is high, in line with the IEMA guidance (IEMA, 2017) that highlights the importance of mitigating GHG emissions to reduce the impacts of climate change.

16.6 Impact Assessment and Mitigation

In line with the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) GHG Protocol guidelines (WBCSD & WRI, 2004), GHG emissions are reported as tonnes of carbon dioxide equivalent (tCO₂e), which takes into account the seven Kyoto Protocol gases:

- Carbon dioxide (CO₂).
- Methane (CH₄).
- Nitrous oxide (N₂O).
- Sulphur hexafluoride (SF₆).
- Hydrofluorocarbons (HFCs).
- Perfluorocarbons (PFCs).
- Nitrogen trifluoride (NF₃).

Where activity data has allowed, expected construction and operational GHG emissions have been quantified using a calculation-based methodology as per the following equation.

$$\text{Activity data} \times \text{GHG emissions factor} = \text{GHG emissions value}$$

A combination of following relevant emissions factors have been used for the purpose of this assessment:



- UK Department for Environment, Food and Rural Affairs (DEFRA) and the Department of Business, Energy and Industrial Strategy (DBEIS) (DEFRA & DBEIS, 2019) GHG reporting conversion factors;
- Embodied carbon benchmark data from the RICS Global Methodology to Calculate Embodied Carbon (RICS, 2012); and
- EU Commission guidelines for the calculation of land carbon stocks (EU Commission, 2010).

16.5.1 In-built Design Mitigation

In-built mitigation has been factored, where possible, into the CO₂e emissions values presented below. However, while carbon offsetting will be undertaken in line with the Net Zero Carbon requirement. As a result of the uncertainty around the specific approach at this stage, this assessment includes all emissions prior to carbon offsetting, and therefore presents a worst-case scenario.

16.5.2 Assessment of Impacts

16.6.2.1 Greenhouse Gas (GHG) Emissions

Construction Phase

The primary GHG emissions sources and the breakdown of the calculated GHG emissions during construction are shown in Table 16-1. A number of assumptions regarding construction GHG emissions, embodied carbon and carbon sinks have been made with detailed construction methods and landscaping plans not being fully developed at the time of this report. These are noted here:

- No estimates for energy and fuel use, material transportation, waste transportation and disposal have been developed for the construction stage. Emissions associated with these activities have therefore not been quantitatively assessed. These aspects have instead been considered qualitatively and it is anticipated that their exclusion will not have an impact on the overall outcome of the assessment.
- The vegetation in AR-SIPVPP is too sparse.
- There are no specific carbon factors available for embodied carbon, vehicle use, water use, and waste disposal specific to KSA. The RICS embodied carbon benchmark (RICS, 2012) and various emissions factors used (DEFRA & DBEIS, 2019) are based on UK construction and energy use data. While they will not directly represent the embodied carbon emissions associated with processes within KSA, they provide a reasonable indication. It is not



anticipated that any inaccuracies inherent within these factors will affect the outcome of the overall assessment.

- The construction workers have been assumed to be transported 1km from their accommodation to the site by Bus and cars each day. The emissions factor for Bus/Cars has been applied, accounting for WTT losses.
- The emissions factors applied are outlined below:

Table 16-1 Construction GHG Emissions approximate from a project of similar components

Project Activity/Emissions	Annual Emissions (tCO ₂ e)
GHGs from on-site power generators, heavy machinery and vessel/vehicle movements	485
Worker transportation	29
Excavation Piling Dozers, levelers Bob Cat etc. and	456
Embodied carbon	6880
Total	6982 ⁵⁶

**The total may not equate to the sum of the emissions reported due to rounding of the decimals.*

Client ACWA Power do not have the details of equipment and GHG emissions as the project is in early stage. ACWA Power will provide the exact values before the commencement of construction

The overall construction emissions equate to approximately 6981tCO₂e over the 30 Months construction period of the Project between 2023 and 2024, resulting in 3491tCO₂e emissions annually. (The calculation is approximate based on the example of a Solar PV Plant equivalent to AR-SIPVPP capacity. This may slightly vary with the equipment and Technology, energy source etc.)

Table 16-2 Impact Assessment for the Lifecycle GHG Emissions during Construction

Impact	Project Phase	Impact Magnitude Ranking	Receptors Sensitivity Ranking	Impact Significance	Residual Impact
GHG emissions from on-site power generators, heavy machinery and vessels/vehicle movements	Construction	Low	Low	Minor	Minor
GHG emissions from embodied carbon through material extraction and manufacturing	Construction	Low	Low	Moderate	Minor

Mitigation:

Enhance:



- Changes in current land use through landscaping will positively impact on carbon sinks. Of course, this enhancement must be assessed in conjunction to the impact on natural habitats and species but where these areas can be mutually beneficial these should be strengthened and maximized.

Avoid:

- The choices of materials and products to be used should be reconsidered through the design development and procurement strategies, particularly in terms of embodied carbon and lifecycle GHG.

Minimize:

- As quantification details emerge, these should be tested against the assumption made in the section as it is critical to the assessment of the carbon offset projects and the commitments made by M/S ACWA POWER to net zero carbon.

The circular economy principles must be embedded in procurement.

Operational Phase

In accordance with the EP4 climate risk management framework the following Green Element (2017) definitions of scope 1, scope 2 and scope 3 climate change emissions have been applied in this assessment:

Scope 1 – All Direct emissions from the activities of an organization under their control. This includes fuel combustion on site, from owned vehicles and fugitive emissions.

Scope 2 – Indirect emissions from electricity purchased and used by the organization.

Scope 3 – All other indirect emissions from activities of the organization, but those occurring from sources they do not own or control, including emissions associated with business travel, procurement, waste and water.

The primary GHG emissions sources and the breakdown of the calculated GHG emissions during operation is shown in Table 16-3. A number of assumptions regarding operation GHG emissions have had to be made due to the lack of detailed operational plan information. These are noted here:

- It has also not been possible to quantify GHG emissions associated with building and infrastructure maintenance during operation due to data limitations at this stage of the design. This aspect has instead been considered qualitatively in section 19.6, and it is not anticipated that this exclusion will have an impact on the overall outcome of the



assessment.

For operational vehicle use, the following assumptions have been made:

- Organic waste is assumed to be composted, while residual waste is assumed to be sent to landfill. For mixed recycling, an average emissions factor for the recycling of glass, metal, plastics and paper/board has been applied.

Table 16-3 Operation GHG Emission

Project Activity/Emissions Source		Annual Emissions (tCO ₂ e)
Vehicle journeys	37 105	4123
Waste disposal	528	44
Water use		718
Total		3674 ⁵⁷

The operational GHG emissions from vehicle journeys, waste disposal and water use equate to approximately 3674tCO₂e annually

Avoid:

The choices of materials to be used should be reconsidered through the design development in particularly in terms of embodied carbon, this is a commitment that emanates through M/S ACWA POWER'S choice to embody Green Building and Sustainability Benchmark requirements in their operations.

Minimize:

As quantification details emerge, these should be tested against the assumption made in the section as it is critical to the assessment of the carbon offset projects and the commitments made by M/S ACWA POWER to net zero carbon.

The circular economy principles must be embedded in procurement.

Table 16-4 Contribution of the AR-SIPVPP Operational GHG Emissions to KSA's Emissions Inventory (Approximate figures)

Project Phase	Relevant Reporting Year	Annual Emissions Inventory (tCO ₂ e) ⁵⁸	Annual GHG Emissions for Reporting Year (tCO ₂ e)	% of Emissions Inventory
Construction	2023	563 333 33	6982	0.00077
Operation	2024/2025	407 500 00	3674	0.00045



16.7 Conclusions

Approximate GHG emissions associated with the construction phase equate to approximately 6981CO₂e (Approximate Value) over the 24 months construction period of the Project between 2023 and 2024, resulting in 3491tCO₂e emissions annually. Annually, operational GHG emissions equate to approximately 3674tCO₂e.

When these GHG emissions are contextualized using KSA's emissions inventory, they account for 0.00077% of annual emissions during the construction phase (2020), and 0.00045% of annual emissions during operation (2024).

Although many assumptions have been made regarding fuel use, transport of waste and materials as well as infrastructure maintenance, once further information becomes available these assumptions must continue to be checked to ensure that the commitments to zero carbon operational energy are upheld.

As construction and operational GHG emissions equate to less than 0.1% of the annual national emissions inventory for KSA, and Scope 1 and Scope 2 emissions are below the threshold of 100 000tCO₂e per annum, the magnitude of impact is low and therefore the construction and operational GHG impact is of minor adverse significance, both in the context of KSA's national emissions inventory and in terms of Scope 1 and Scope 2 emissions arising from a single development.

As the GHG emissions are of minor adverse significance, no additional mitigation and monitoring is required during the construction or operation of the Project.



SECTION 17.0 CUMULATIVE IMPACT ASSESSMENT



SECTION 17.0 CUMULATIVE IMPACT ASSESSMENT

17.1 Introduction

An assessment of potential cumulative impacts of the Project together with other developments that will also have impacts within the Project's area of influence was conducted to align with the requirements of IFC PS1. The approach taken was based on the IFC's Good Practice Handbook for Cumulative Impact Assessment and Management (2013).

According to the IFC's Good Practice Handbook (2013), a cumulative impact is defined as, "...those that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to as 'developments') when added to other existing, planned, and/or reasonably anticipated future ones".

Cumulative Impact Assessments (CIA) should fall under the remit of government and regional planners as much of the detailed information regarding other development plans in the region is not always publicly available. However, the IFC recognizes that in some instances, private sector developers need to consider cumulative impacts in the identification and management of environmental and social impacts and risks (refer to IFC PS1). To this end, IFC good practice guidance introduces the concept of a rapid CIA (RCIA), which sets out a preliminary approach for project proponents to integrate into the ESIA process.

It is important to acknowledge the differences between those actions over which a project proponent has direct control over and those for which it may have leverage to influence others to achieve optimal management as part of a multi-stakeholder and cooperative governance effort. It should be noted here that to date stakeholder engagement has occurred in this ESIA process between M/S ACWA Power Company (Saudi Listed Joint Stock Company), EBC and respective stakeholder groups except few cultural and political limitations and the lack of any enabling KSA legislation.

There is also no specific requirement for the CIA process set out in the KSA legislative framework, therefore this CIA will follow best international practice as set out in the IFC guidelines.

The assessment of cumulative impacts is a long-established requirement for any comprehensive ESIA. The IFC Performance Standards and IFC Good Practice Note: Cumulative Impact Assessment and Management Guidance for the Private Sector in Emerging Markets (GPH) has been used to inform the assessment process. IFC PS1 defines cumulative impacts as: "...impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other



existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted”. The impacts of the Project need to be considered in conjunction with the potential impacts from other future developments or activities that are existing, planned or reasonably defined and are located within a geographical scope where potential environmental and social interactions could act together with the Project to create a more or less significant overall impact. ACWA Power Company (Saudi Listed Joint Stock Company), construction works ESIA address works associated with the construction and operation phase of the Project as described in section 3.

CIA Process

IFC good practice for the private sector management of cumulative impacts considers a two-pronged approach:

- Effective application and adherence to the mitigation hierarchy of specific contributions by a project to the expected cumulative impacts; and
- Best efforts to engage in enhance, and/or contribute to a multi-stakeholder, collaborative approach to implementing management actions that are beyond the capacity of an individual project proponent.

It should be kept in mind that the process for the CIA should be kept flexible, the steps set out above don't necessarily need to follow in sequence, and may need to be implemented iteratively, with some steps revisited in response to the results of others, and as more Project information becomes available. This is particularly relevant here with the regional project all in very early stages of concept planning.

It is expected that this RCIA will evolve into a full CIA, with additional focused regional surveys of the identified priority valued environmental and social components (VECs), as a collective effort through collaboration with PIF regional planners.

Spatial and Temporal Boundaries

The Area of Influence (AoI) of the ACWA Power Company (Saudi Listed Joint Stock Company), is shown in Figure 17.1

The temporal scope for the CIA is defined in relation to the construction and operational phases of the Project. The year 2024 is assumed when the development will be fully operational, and the full extent of operational impacts would be realized.

Therefore, based on the above, and linked to the results of the Project ESIA, the priority VECs selected for the RCIA are:



- Climate change resilience;
- Employment opportunities;
- Economic development and fiscal impact;
- In-migration of work force;
- Restriction and/or disruption of movement patterns;
- Displacement of persons residing on or making use of the land;
- Demand on existing waste management infrastructure;
- Natural and protected habitat and species; and
- Terrestrial natural and protected habitats and species; and
- Transportation and Traffic.

17.2 Scope of the Assessment

17.2.1 Rapid Cumulative Impact Assessment

Section 1.5 of the GPH states that “Unlike government agencies, a private sector developer or project sponsor has no control over the actions undertaken by other developers that affect similar [Valued Environmental Components VECs, and therefore it is unlikely to have much leverage to influence any mitigation actions by third parties. However, when faced with cumulative impacts and risks, private sector developers or project sponsors may engage in a simpler [Rapid Cumulative Impact Assessment] RCIA process instead of a full CIA. An RCIA follows the same logical and analytical framework as a CIA, but the analysis is based on a desk review of readily available information and previous environmental and social assessments. The Executive Summary of the GPH provides that “The RCIA can be an integral component of the ESIA or a separate process”. It entails a desk review that, in consultation with the affected communities (If any) and other stakeholders, enables the developer to determine whether its activities are likely to significantly affect the viability or sustainability of selected VECs. The proposed approach recognizes that, especially in emerging markets, the many challenges associated with managing a good CIA process include lack of basic baseline data, uncertainty associated with anticipated developments, limited government capacity, and absence of strategic regional, sectoral, or integrated resource planning schemes.”

17.2.2 Rapid Cumulative Impact Assessment Methodology

The Figure below illustrates the RCIA logical framework, which is an iterative six-step process: scoping (Steps 1 and 2), VEC baseline determination (Step 3), assessment of the contribution of



the development under evaluation to the predicted cumulative impacts (Step 4), evaluation of the significance of predicted cumulative impacts to the viability or sustainability of the affected VECs (Step 5), and design and implementation of mitigation measures to manage the development's contribution to the cumulative impacts and risks (Step 6).

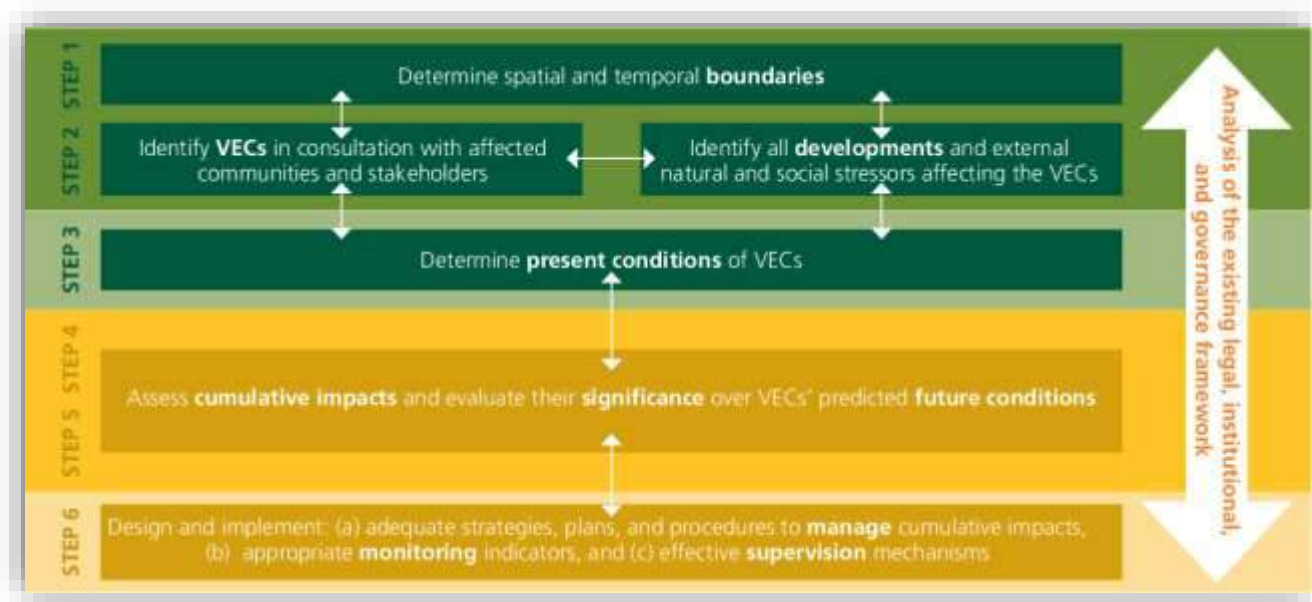


Figure 17-1 CIA: Six-Step Approach

17.2.3 Screening

The GPH provides guidance on the RCIA screening output scenarios that are applicable to the Project:

- Significant risk for cumulative impacts/significant leverage: The development under consideration represents a significant contributor to the expected cumulative impacts or will be the first of several future reasonably anticipated developments that will use the same resource and/or potentially affect the same VECs. In these cases, through consultation with stakeholders, the RCIA will help assess potential cumulative impacts that could be expected over time and guide the developer in defining the required mitigation measures. The private developer can use Step 6 to design a strategy to appropriately manage cumulative impacts and provide advice to the government on the appropriate governance structure to ensure other developers will follow suit. This is an ideal case, where the private sector sponsor can



capitalize on the ESIA process, including baseline generation and stakeholder engagement, and the RCIA may organically evolve into a more robust CIA process and contribute to leveraging

- Significant risk for cumulative impacts/limited leverage: The development under consideration is immersed in an environment where the cumulative impacts are evident, but the issues are complex, many actors are already involved, and the solution is clearly beyond any individual project sponsor. In this case, the RCIA will help the developer (a) determine the significance of the overall cumulative impacts and its contribution to these cumulative impacts, and (b) design environmental and social management plans and procedures to appropriately mitigate those contributions. In this case, the developer should be accountable only for the design and implementation of mitigation measures commensurate with the magnitude and significance of its contribution to the cumulative impacts. However, individual sponsors should use their best efforts to engage other developers, governments, and other stakeholders in acknowledging the cumulative impacts and risks and in designing coherent management strategies to mitigate them.
- Limited to no contribution to cumulative impacts: The RCIA determines that even though there are clear cumulative impacts, the development's contribution to the cumulative impacts over the affected VECs is negligible or nil. In this case, no measures other than the ones resulting from the ESIA process would be necessary. In this situation, however, if there are cumulative impacts from other sources that are not being addressed, the developer may consider it pertinent to draw this to the attention of the government or other stakeholders and assess whether its project may be at risk from the unmanaged cumulative effect.

17.3 Cumulative Impacts of Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project

Impacts directly associated with the Project are discussed in the previous sections. In this section, the potential impacts associated with the cumulative effects of the Project and other developments in the area are described.

Cumulative impacts occur when a Project activity acts together with other activities (other projects or third-party activities) to impact on the same environmental or social resource or receptor. The IFC defines cumulative impacts as *“impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing,*



planned or reasonably defined developments at the time the risks and impacts identification process is conducted”.

Cumulative effects are difficult to predict as they are the result of complex interactions between multiple projects or activities. This difficulty is compounded by the fact that details of the future development are largely unknown at this stage. Moreover, whether or not a potential future development actually occurs is dependent on a number of factors that are unknown at the time of this assessment. Consequently, cumulative impacts are qualitatively assessed herein, i.e. high-level descriptions of the potential impact are provided.

Mitigation and management of cumulative impacts often require cooperation with other stakeholders or at a government level and are frequently beyond the ability of a single project development to control solely.

In line with international good practice, mitigation should be commensurate with the level of contribution to the cumulative impact by the developer. Past and present activities were considered in developing the environmental and social baseline against which the Project is assessed, thus, such previous activities have already been considered in this ESIA and used as the baseline to assess the potential impacts of the proposed Project activities. Beyond the past and present activities, the following have been identified as ‘reasonably defined’ activities that could act together with the Project to cumulatively affect the environment:

- Improvement of AR-SIPVPP for the better Plant operations; and
- Improvement of Environmental conditions of AR-SIPVPP.

The cumulative impacts identified below have been assessed against only Air Quality, Visual and Noise, Community Health and Safety, and Terrestrial Bio diversity and Livelihoods and Businesses. No other receptors identified in the above sections are considered to be impacted by the known plan developments as discussed below.

17.3.1 Cumulative impacts of refurbished AR-SIPVPP

Air quality (through exhaust emissions and dust)

If AR-SIPVPP is implemented as per the plan, and the proposal of renewable energy for PV Solar Plant is considered to avoid GHG emissions; the cumulative impact on air quality is not significant. But the GHG emission calculation is low as calculated.

Visual and noise



Construction of a AR-SIPVPP will not substantially change the visual impact of the area. Furthermore, as there are no receptors adjacent to the AR-SIPVPP the potential impact on visual and noise is **minor**. Noise is short term and Temporary

Terrestrial Ecology

Construction of AR-SIPVPP will not substantially change the Terrestrial ecology. There are no diverse vegetation in the AR-SIPVPP area and after completion of the project the area offers a new habitat for avifauna.

Community health and safety

No communities are situated within AR-SIPVPP, and so community health and safety as a result of the AR-SIPVPP is considered **minor**.

Economics and livelihood

The construction of AR-SIPVPP will lead to additional temporary and permanent job creation, of varying skill levels. It will resolve the problems of eco-friendly solar power demand to central province and therefore improved system of adequate power supply and delivery. This therefore will be a **positive** impact.

17.4 Mitigation and Management of Cumulative Impacts

The effective mitigation and management of cumulative effects requires engagement in a multi-stakeholder, collaborative manner that is beyond the capacity of the individual Project to implement. In order to achieve this, and following IFC Guidance, there will be a need to design and implement: (a) adequate regional strategies, plans, and procedures to manage cumulative impacts, (b) appropriate monitoring and reporting programmes against key performance indicators, and (c) effective supervision mechanisms.

M/S ACWA Power principles and commitments set out in Section 3 Project Description and Alternatives of the ESIA provide a strong basis for addressing the identified cumulative impacts.

Key areas for engagement and influence are highlighted below:

- **Adaptation and Resilience Measures** – much has been done through the design to build in setback areas for ecological conservation. These should be considered too in terms of adaption for resilience against climate change effects such as sea level rise, great flood intensity and hotter, drier climates. Further, the design of assets, particularly infrastructure has and must continue to adopt the 100-year plus 20% flow requirements.
- **Environment and Conservation Zoning Plans** (EZP) should be developed in order to



protect important biodiversity and cultural heritage values by restricting development within the AR-SIPVPP development and the surrounding environment. The EZP should be developed to inform the Detailed Master plans and should rigid development controls and management measures to enhance the biodiversity / cultural value within each zone.

- The Biodiversity Offset Strategy Framework (provides an outline for the management biodiversity offsetting towards the commitment of biodiversity.
- Providing support to staff, local communities as well as local and regional government through skills development, on-the-job training, and awareness and capacity building programmers' through the various research facilities.
- Coordinate corporate social responsibility initiatives in line with local economic development targets and supporting secondary industries such as local recycling and composting businesses.
- Continue collaboration with regional and national government and the other development planners to enhance their collective buying power for recycling and potentially expand this to other local secondary industry requirements.
- On-going commitment to the requirements sets out in the CESMP, including monitoring, auditing and reporting. The development of an Operational ESMP must also be developed prior to operation commencement to ensure ongoing management, mitigation and monitoring of impacts is undertaken. These documents remain interactive and should be reviewed regularly as part of M/S ACWA Power principles' commitment to continuous improvement as well as to apply learning from monitoring and auditing.
- A regional traffic impact assessment should be undertaken at detailed design to inform the at grade and grade separated junction designs and turning lanes required for construction as well as to appropriately ascertain the impact to Ar Rass specifically with regards to safe pedestrian crossings and speed control measures.



SECTION 18.0 FRAMEWORK CONSTRUCTION ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN



SECTION 18.0 FRAMEWORK CONSTRUCTION ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

18.1 Introduction

Environmental Balance Establishment (EBE) has been appointed by M/S ACWA Power Company (Saudi Listed Joint Stock Company), to conduct ESIA for Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass. The Environmental and Social Impact Assessment (ESIA) study for Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass has been presented in compliance with the Appendix 2.4 of General Environmental Regulations and Rules for Implementation (GERRI, 2001) of NCEC -KSA and Equator Principles 2020 IFC-ESIA Guidelines. The environmental assessment study assures compliance with the regulatory requirements; identifies and analyzes sensitive components of the existing environment; determines the type, nature and importance of the probable environmental impacts during construction; identifies and recommends practical effective mitigation measures; recommends a framework for an environmental management and monitoring plan for the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass Project; and ensures that all stakeholders deemed to be influenced by the projects or activities are fully considered.

This Framework Construction Environmental and Social Management Plan (CESMP) provides a framework for the Construction Contractors (Design & Build (DB) Contractors) to develop their CESMPs to implement environmental mitigation and enhancement measures proposed in the Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass - ESIA and to comply with GIIP: IFC PS1 Assessment and Management of Environmental and Social Risks and Impacts, 2012 for environmental protection during construction.

18.1.1 Background and Scope of the CESMP

AR-SIPVPP development (herein referred to as The Project) is located approximately 25 km from Ar Rass Centre.

18.2 Objectives of the CESMP

A Construction Environmental and Social Management Plan (CESMP) is an environmental management tool used to prescribe management mechanisms or methods for the prevention of undue or reasonably avoidable adverse environmental and social impacts and for the enhancement of the positive environmental and social benefits of a development. The CESMP is based on the findings of the AR-SIPVPP - ESIA.



A CESMP describes the measures that need to be taken to ensure that responsibility is bestowed upon those who cause, have caused or may in future enhance environmental and social impacts.

The CESMP is used to guide and regulate environmental performance through all stages of development, including planning, design, construction, rehabilitation and maintenance, and eventual decommissioning of temporary facilities and infrastructure (as applicable). This CESMP has been compiled in compliance with the IFC PS1 Assessment and Management of Environmental and Social Risks and Impacts, 2012.

This Framework CESMP for the AR-SIPVPP development will be provided to the Contractor(s) for costing purposes and becomes legally binding on the Contractor(s) and anyone acting on behalf of the Contractor(s) during construction, operational, maintenance and decommissioning activities.

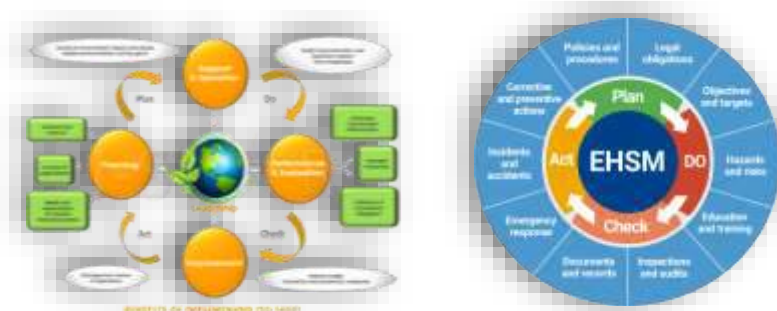
This Framework CESMP was compiled as a stand-alone document and includes potential impacts associated with construction activities associated with the Project. The CESMP is designed to be as site-specific as possible based on the information available at the time. In addition, this CESMP is a dynamic and flexible document and may need to be updated on a regular basis, as directed by the Environmental Manager.

Where construction is staged, the CESMP should be reviewed and updated as a minimum, prior to each construction stage. Any additional inputs from these stages must be formally incorporated into the updated CESMP for activities going forward, as directed by the Environmental Manager.

18.2.1 Roles and Responsibilities

18.2.2 Management Approach

A typical management process is structured around six steps: ‘policy, organize, plan, implement, monitor and review’, to ensure continuous improvement in performance’ as depicted in Figure 19-1.



Adapted from management systems principles of International Organization for Standardization (ISO) 14001 and Occupational Health and Safety Assessment Series (OHSAS) 18001

Figure 18-1 EHS Management System Framework



The construction contractors' CESMP(s) are expected to follow a similar management approach. The requirements by the construction contractors to follow this process is outlined in this document. The environmental management of the project will be conducted within a comprehensive framework, based on this model, comprising:

- M/S ACWA Power Company (Saudi Listed Joint Stock Company) Policies (Section 2: Policy, Regulatory and Administrative Framework);
- Construction contractor's EHS Policies;
- Dedicated contractor personnel to implement mitigation measures and to provide oversight and support of the construction contractors activities;
- Framework CESMP (this document);
- Training Programmers;
- Specific Management Plans developed by construction contractors; and
- Monitoring Programme.

18.2.3 Organizational Structure and Responsibilities

ACWA Power Company (Saudi Listed Joint Stock Company) s leadership is accountable for the protection of the environment. This accountability is delivered through a clear set of responsibilities assigned to M/S ACWA Power functions and its supply chain delivering the programme. Implementation of this Framework CESMP is the responsibility of the construction contractors while M/S ACWA Power will undertake reviews and audits to ensure this Framework CESMP and the construction contractors' CESMP(s) are implemented. These plans summarize the specific actions, procedures or mitigation measures that will be implemented to reduce the potential impacts. The plans also identify the personnel responsible for implementing the required procedures or mitigation actions and monitoring, reporting and documentation requirements and the key indicator(s) of compliance with the mitigation measures. The key project and environmental responsibilities for environmental management during AR-SIPVPP construction phase are described in the following sections.

18.2.2.1 Senior/Top Management Review of EHS Management System

Top management should review the ACWA POWER organization's EHS management system at regular intervals to ensure its continuing suitability, adequacy, and effectiveness. This review includes assessing opportunities for improvement and the need for changes in the management system, including the EHS policy and objectives. The results of the management review should be documented.



Among other information, a management review should include the following:

- Results of EHS management system audits,
- Results from any external audits,
- Communications from interested parties,
- Extent to which objectives have been met,
- Status of corrective and preventive actions,
- Follow-up actions from previous management reviews, and
- Recommendations for improvement based on changing circumstances.

The outputs from management review should include any decisions and actions related to possible change to EHS policy, objectives, and other elements of the management system, consistent with the commitment to continual improvement.

The management system review ensures a regular process that evaluates the EHS management system in order to identify deficiencies and modify them. Systemic gaps, evidence that targets are not being met, or compliance issues that are discovered during compliance or risk assessments indicate a possible need for revision to the management system or its implementation.

Principles:

- **Line management responsibility for safety.** Line management is directly responsible for the protection of the public, the workers, and the environment. As a complement to line management, the ACWA POWER 's Environment, Safety, and Health provides safety policy, enforcement, and independent oversight functions.
- **Clear roles and responsibilities.** Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.
- **Competence commensurate with responsibilities.** Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.
- **Balanced priorities.** Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.
- **Identification of safety standards and requirements.** Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards and requirements shall be established which, if properly implemented, will provide adequate



assurance that the public, the workers, and the environment are protected from adverse consequences.

- **Hazard controls tailored to work being performed.** Administrative and engineering controls to prevent and mitigate hazards shall be tailored to the work being performed and associated hazards.
- **Operations authorization.** The conditions and requirements to be satisfied for operations to be initiated and conducted shall be clearly established and agreed upon.

Functions:

- **Define the scope of work.** Missions are translated into work, expectations are set, tasks are identified and prioritized, and resources are allocated.
- **Analyze the hazards.** Hazards associated with the work are identified, analyzed, and categorized.
- **Develop and implement hazard controls.** Applicable standards and requirements are identified and agreed upon, controls to prevent/mitigate hazards are identified, the safety envelope is established, and controls are implemented.
- **Perform work within controls.** Readiness is confirmed and work is performed safely.
- **Provide feedback and continuous improvement.** Feedback information on the adequacy of controls is gathered, opportunities for improving the definition and planning of work are identified and implemented, line and independent oversight is conducted, and, if necessary, regulatory enforcement actions occur.

18.2.2.2 Overview of Key Project and Environmental Management Responsibilities

This Framework CESMP must be implemented by the construction contractors with oversight from ACWA POWER as follows:

- Construction contractors must implement and adhere to their CESMPs, as well as AR-SIPVPP Framework CESMP. Any uncertainties about the CESMP must be clarified with ACWA POWER prior to commencing work;
- Construction contractors must make the necessary resources available to address implementation of all the AR-SIPVPP Framework CESMP requirements;
- Construction contractors must ensure the appointment of appropriate personnel to implement the construction
- Contractor's CESMPs successfully;



- ✦ Construction Contractors must ensure that roles, responsibilities and authorities have been defined, documented and communicated in order to facilitate compliance with the AR-SIPVPP Framework CESMP;
- ✦ Where required by ACWA Power, Construction Contractors must provide a “method statement” stating how the construction contractor intends to meet the requirement of AR-SIPVPP Framework CESMP;
- ✦ Construction Contractors must ensure that all Construction Contractor’s staff members, sub-contractors and
- ✦ Suppliers understand and adhere to their CESMP(s); and
- ✦ Construction Contractors must ensure that all their staff are appropriately trained.
- ✦ The Construction Contractors are required to include their organization chart in their CESMP. The main responsibilities of key staff from ACWA POWER and construction contractors are described in section 19.4.2.2 and 21.4.2.3, respectively.

18.2.2.3 M/S ACWA POWER

ACWA POWER is accountable, as project proponents, with the overall responsibility of environmental management and compliance with this Framework CESMP. It is also responsible for any interface with regulatory authorities and local communities on land tenure and compensation issues.

18.2.2.4 Construction Contractors

The construction contractors will carry out construction activities, under the supervision of ACWA POWER and their consultant. The construction contractors have obligations under KSA’s environmental laws and under its contract with ACWA POWER. The responsibility for implementation of this Framework CESMP and their individual CESMP(s) rests with the construction contractors. It is expected that construction contractors will:

- Assign responsibilities, documented through signed job descriptions, to individuals within their project teams to facilitate the implementation of the Framework CESMP and Construction Contractors’ CESMP and allow for effective communication between ACWA POWER’s project management and the environmental management roles within their project teams;
- Develop a site specific CESMP compliant with this Framework CESMP;
- Have their CESMP as well as their quality assurance processes approved by ACWA POWER prior



to commencement of construction or as early as is practicable thereafter;

- Develop the Construction Contractors' CESMP consistent with the level of environmental specifications and
- Safe guards set out in this Framework CESMP; and
- Provide project personnel and workers with appropriate training to implement and monitor implementation of the Framework CESMP and their site-specific CESMP(s); the Construction Contractor's internal Health, Safety and Environmental (HSE) guidelines and standards and ACWA POWER's contract requirements with construction contractors.

Construction contractors must provide adequate resources to implement and monitor compliance with this Framework CESMP and their site-specific CESMP(s).

18.3 Communication

Communications and consultations are the integral part of AR-SIPVPP Framework CESMP. This involves communications aimed at keeping ACWA POWER's project management, the Construction Contractors and other key stakeholders and potential external parties (if required) informed about the progress of the work and environmental monitoring activities.

18.3.2 Internal Communication

Effective and timely communication is critical to the effective implementation of the CESMP(s) and therefore, all personnel including ACWA POWER, Construction Contractor's site personnel including subcontractors, if any, must attend an awareness induction prior to starting work in order to gain a better understanding of the environmental issues and associated main mitigation measures related to the Project.

The following means which include visual displays forums and reporting mechanism will be utilized by the Construction Contractors to ensure effective communication between the Project team.

18.3.2.2 Site Bulletin Boards

The Construction Contractors will install and maintain bulletin boards at site offices and strategic locations within the site to include as a minimum the following:

- Contact details of key members such as Project Manager, Environment and HSE Manager;
- Project site layout plan showing locations of offices, welfare facilities etc.;
- Site mandatory Personal Protective Equipment (PPE) requirements;
- Emergency Response contact numbers; and
- Site environmental awareness posters.



18.3.2.3 Monthly Environmental and Social Performance Meetings

Meetings will be held monthly and will be attended by key project management staff from ACWA POWER and Construction Contractors. Environmental and social issues will be included as a permanent agenda item for all meetings. Items to be discussed will include environmental incidents and their management, environmental key performance indicators (KPI) and their achievement, monitoring data, outcomes of inspections and audits, the need for revisions to the CESMP, and workforce awareness. In addition, interactions with the community will be addressed including grievances and requests for employment.

18.3.2.4 Weekly Environmental and Social Performance/ HSE Status Meetings

Matters concerning environmental protection and related issues will be discussed during weekly HSE meetings which will be chaired by the Construction Contractor's Environment/Social Manager or the HSE Manager. Participants of this meeting must include Construction Contractor's Project Manager, Environmental and Social Officers and representatives of subcontractors and suppliers (when required considering the type of material supplied such as chemicals which may have environmental implications). Items to be discussed will include topics such as environmental incidents and their management, worker and community grievances, monitoring requirements, spill response procedures, operational controls (developed under the Framework and Construction Contractor's CESMP(s) and roles and responsibilities of employees under the CESMP(s).

18.3.3 Reporting

18.3.3.2 Daily Environmental Observation Checklist

The Construction Contractor must submit daily reports to ACWA POWER which will contain the observations recorded at site during the daily site walkover. The Construction Contractor must utilize an appropriate site inspection checklist for the purpose which will address the items mentioned in the Mitigation Management Matrix (Table 18-4). This report will be submitted the same day after completion of the site visit.

18.3.3.3 Weekly Report

Weekly report must be submitted in a suitable format developed by the construction contractor which must show a compilation of the observations conducted during the period, with data collected during the daily visits and supported by verifiable evidence. It must include an aggregate summary of observations and progress during the week including, but not limited to, the following matters:



- Waste Disposal Records;
- Water consumption;
- Fuel consumption;
- Non-conformances recorded and their status (closed/open);
- Trainings conducted; and
- Any environmental issues or concerns identified.

18.3.3.4 Monthly Report

Construction Contractors must submit Monthly Reports highlighting the environmental and social monitoring activities carried out during the month with the information specified in the Mitigation Management Matrix (refer to section 18.10) and in accordance with the format presented in the Construction Contractors approved CESMP. Monthly reports must be submitted to ACWA POWER within the first week of every month.

The Construction Contractors' monthly report will contain the following information:

- A brief description of the construction works completed during the month;
- Updated site layout drawing (or logistics map) showing locations of the following (if updated);
 - Waste collection areas (all types of wastes including wastewater);
 - Sanitary facilities (e.g. toilets) and rest areas;
 - Hazardous materials storage areas (e.g. chemical stores, fuel tanks, gas cylinders); and
 - Construction access roads.
- Air quality monitoring results (where monitoring is required);
- Environmental and occupational noise monitoring results;
- Fuel and water consumption quantities;
- Vehicle maintenance and inspection records;
- Summary of findings from the daily site inspections highlighting good practices and nonconformance's;
- Any revisions of project environment and social related documents conducted during the period;
- Updated complaints/grievance register (if any) with actions taken to resolve such complaints;
- Community interactions (e.g. employment requests);
- A summary of waste disposal volumes for all types of wastes, transporter and final receiving facility details for all types of wastes;
- Trainings records (site induction and any specialized environmental trainings conducted);



- Results of soil analyses if conducted;
- Labour camp inspection reports;
- Drinking water test reports;
- Summary of health monitoring conducted and report of any work health related incidents;
- Road traffic checks if any conducted in community areas; and
- Internal and external audit reports

18.3.4 External Communications

18.3.4.2 Site Signage's

A billboard with the details of the project must be erected at the entrance to the project site in order to communicate important details to external parties. The billboard must, as a minimum cite the following information:

- The name of the project and the number of the contract;
- The name of the party supervising the project and its address (office number, fax number) and the name of the head of unit and his mobile number; and
- The name of the Contractor, and its address (office number, fax number), and the head of department and his mobile phone.

18.3.4.3 Incident Reporting

Any major incident such as spills or uncontrollable fire, if occurs must be reported to concerned authorities as discussed. The responsibility for reporting to external entities will primarily be that of ACWA POWER. ACWA POWER Construction Supervision Superintendent overseeing construction activities should manage communications internally. External communication should be managed through the ACWA POWER - AR-SIPVPP Project Manager.

Construction Contractors will fully support ACWA POWER by providing adequate information related to the incident for the purpose.

18.3.4.4 Stakeholder Engagement and Grievance Feedback

ACWA POWER will develop and implement a SEP and Grievance Mechanism. During construction, residents may raise complaints or submit their grievance as a result of construction activities. The Construction Contractor will ensure that grievances are addressed in accordance with the approved project grievance protocol and provide feedback to the complainant in consultation with ACWA POWER where required. ACWA POWER Construction Supervision Superintendent overseeing construction activities should record community



grievances internally. Thereafter, the A C W A P O W E R Corporate Environmental/Social Compliance Lead should follow up and address the grievances with A C W A P O W E R - AR-SIPVPP Project Manager. Consultation with stakeholders shall take place in accordance with the SEP.

18.4 Monitoring

The objective of environmental monitoring during the construction will be as follows:

Compliance Monitoring: Compliance with the requirements of the AR-SIPVPP Framework CESMP will be checked by monitoring the activities of the construction contractors. The monitoring and frequency thereof have been listed in the Mitigation Management Matrix (MMM), Table 18-4.

Effects Monitoring: The actual impact of the project activities on physical, biological, and socioeconomic receptors of the project area will be monitored by each Construction Contractor for their area of activity and by ACWA Power where appropriate so that any effects either not anticipated in the ESIA or exceeding the levels anticipated in the ESIA can be identified and appropriate mitigation measures can be adopted in time.

To achieve these objectives the following monitoring programmed will be implemented.

18.4.2 Compliance Monitoring

Compliance monitoring of the construction activities is principally a tool to ensure that the environmental control measures required in the ESIA and listed in the MMM (Table 18-4) are strictly adhered to during the construction phase of the project.

The objectives of the compliance monitoring will be to:

- Systematically observe the activities undertaken by the construction contractors or any other person or supplier associated with the project;
- Verify that the activities are undertaken in compliance with the ESIA and other conditions identified by A C W A P o w e r ;
- Document and communicate the observations to the concerned person(s) in the Construction Contractor's management team and ACWA Power so that any corrective measures, if required, are undertaken in a timely manner; and
- Maintain a record of all environmental incidents and related actions and corrective measures.

The MMM will be used as a management and monitoring tool for compliance monitoring. The Construction Contractors within its CESMP(s) will develop a monitoring plan to implement the



monitoring requirements listed in the MMM. The requirement by the Construction Contractors to include this in their CEMP(s) is mentioned in section 18.4.2.3.

18.4.3 Effects Monitoring

The actual impact of the project activities on physical, biological, and social receptors in the project area will be monitored so that any effects that are either not anticipated in the ESIA or exceeding the levels anticipated in the ESIA can be identified and appropriate mitigation measures can be adopted in time. Broadly, effects monitoring (also called effectiveness monitoring and impact monitoring) has four objectives:

- To verify that the impact of the proposed project is within acceptable limits, thus establishing credibility (public assurance);
- To facilitate research and development by documenting the effects of the proposed project that can be used to validate impact-prediction techniques and provide a basis for more accurate predictions of future impact;
- To immediately warn the project proponent and the regulatory agencies of unanticipated adverse impact or sudden changes in impact trends so that corrective actions can be undertaken, which may include modifications in the proposed activities, or the inclusion of modified or additional mitigation measures; and
- To provide information to plan and control the timing, location, and level of certain project activities so that the effects are minimized.

The common theme of the above objectives is the proper management of environmental risks and uncertainties. ACWA Power- ESIA predicts the impact of the proposed project on the basis of information available in the environment and the natural processes that link various environmental parameters. Based on this prediction, mitigation measures are introduced such that the predicted residual effects do not exceed acceptable levels. However, there is always an element of uncertainty in such predictions due perhaps to an insufficient grasp of the processes, limitations in prediction techniques, or inadequate data on the environment. This is true for the physical, biological, as well as socioeconomic environment. Consequently, it is possible that even if the control measures are implemented fully, the negative impact of the project may exceed acceptable limits.

Effects monitoring for the construction activities will include monitoring of:

- Terrestrial Ecological Environments (i.e. nesting, migratory corridors and breeding patterns);



- Waste (split in to waste stream, including sewage);
- Air emissions from vehicles, equipment and generators;
- Noise;
- Environmental incidents, including spills;
- Geological Features; and
- Grievances of Workforce or impacted communities

The MMM will be used as a management and monitoring tool for effects monitoring. Each Construction Contractor within its CESMP will develop a monitoring plan to implement the monitoring requirements listed in the MMM.

18.4.4 Findings of Noncompliance

Compliance with both ACWA Power- AR-SIPVPP Framework CESMP and Construction Contractor's CESMP(s) is a requirement and mandatory. Failure to comply will result in issuance of a non-compliance record (NCR). The purpose of an NCR is to:

- Provide clear communication between environmental monitoring personnel,
- Construction Contractor's management and ACWA Power;
- Ensures responsible personnel are kept informed regarding any gaps in Construction Contractor's environmental performance; and
- Helps effectively and expeditiously resolve environmental non-compliance situations.

The following procedure is proposed for the issuance of NCR, to give complete and accurate documentation and to achieve rapid resolution of the NCR.

18.4.4.2--NCR Issuance

A tiered approach for communication and response to non-compliance situations will be implemented.

When an issue is identified, the contractor must be informed of a potential discrepancy between its activity and ACWA Power- AR-SIPVPP framework CESMP and/or their own CESMP(s). If the situation is immediately corrected, the concern and response is reported in the monitoring report and no further action may be necessary.

However, if the situation is not corrected immediately (1 - 7days depending on the severity of the impact or potential of the impact to cause further damage), an NCR may be issued, depending on the severity of the situation. Three categories are proposed:

- **Level I NCR**—A non-compliance situation that is not consistent with CESMP



requirements, but not considered to represent an immediate threat to an identified important resource. This includes environmental near misses;

- **Level II NCR**—A non-compliance situation that has not yet resulted in a ‘clearly identified damage’ or irreversible impact to a sensitive or important resource but requires expeditious corrective action and site- specific attention to prevent such effects, or an unresolved Level I NCR; and
- **Level III NCR**—A major non-compliance situation, typically including observed damage to a specifically protected sensitive resource or a reasonable expectation of impending damage or an unresolved Level II NCR.

Issuance of an NCR requires notification to ACWA Power- at increasing levels of urgency, depending on severity. Similarly, resolution of corrective action will also involve elevated levels of management on both sides. Once the issue has been resolved, an incident investigation team, comprising both of ACWA Power and Construction Contractor personnel, may need to be formed, to determine if process changes are required. Construction contractors are required to develop a detailed NCR Issuance procedure as part of their CESMP(s). All NCRs must be reported to A C W A P o w e r with the weekly environmental metrics report. An NCR will be considered unresolved after 7-14 days at the discretion of the Environmental and Social Manager.

18.5 Documentation

Accurate documentation is essential for tracking and evaluating the implementation and effectiveness of AR-SIPVPP Framework CESMP and Construction Contractor CESMP(s). Each CESMP must identify the specific reporting and documentation requirements. Processes must be in place for controlling documentation and to ensure that it is available at all time, valid and current. All documentation becomes a part of the environmental site history file. The construction contractors will maintain records and track performance. The following documents that are to be kept onsite include, but are not limited to:

- Approved record of amendments to AR-SIPVPP - Framework and Construction Contractors’ CESMP(s) or other plans;
- Copies of All plans, procedures, list and reports or documents required by AR-SIPVPP Framework and Construction Contractors’ CESMP(s);
- Permits and authorizations issued by AR-SIPVPP and regulatory/local authorities;
- List of chemicals stored on site including Material Safety Data Sheets (MSDS);



- Non-compliance, corrective action and incident reports;
- Medical records;
- Environmental and social training records;
- Complaints and incident register (i.e., through Grievance mechanisms);
- Audit and inspection reports;
- Monitoring and inspection checklists;
- Weekly and monthly environmental and social performance reports;
- Change Management/Review records;
- Waste disposal/transfer ; and
- Quantitative waste metrics, by waste stream.

18.6 Self-Assurance, Audits and Review

Self-assurance audits/reviews are conducted by the construction contractors to verify the implementation and effectiveness of their CESMP(s). This section of the Construction Contractors' CESMP(s) must provide details/schedule of construction contractors' self-assurance plan. ACWA Power-may also choose to implement an Audit programme to ensure that this CESMP is being implemented. They may identify their internal resources or deploy

A waste transfer/disposal note is a required piece of documentation which must be completed when waste changes hands. This means that if a business requires waste to be disposed of, or waste collected by a waste disposal company is then passed over to another business/authority, perhaps for recycling or processing, a waste transfer/disposal note must be completed and verified by both parties involved in the exchange.

Teams from their environmental supply chain to undertake these audits. The section will provide a tabular detail as below:

Table 18-3 Audit Plan

Category	Type of Activity	Frequency	Responsibility	Reporting
Self-Assurance Audit	Review of the daily environmental site inspection reports, weekly environmental and social Performance reports and the monthly environmental report.	Weekly	Construction Contractor HSE / Environmental/Social Manager	Through Weekly Environmental and Social Performance Report



The ACWA Power- AR-SIPVPP Audit	Validate Construction Contractors' environmental governance, weekly environmental reports and the monthly environmental report	Monthly	ACWA Power- AR-SIPVPP Corporate Environmental Compliance Lead	Audit Report

18.7 Awareness, Training and Inductions

The main objective of the environmental awareness and training programme is to ensure that all personnel involved in construction of AR-SIPVPP are aware of their individual responsibilities under AR-SIPVPP Framework CESMP. Additional Contractor specific HSE training and induction programmes for all staff must be provided in the Construction Contractors CESMP, as needed. Specific training components must focus on receptor awareness and sensitivities. The need for follow-up training must be based on the incidences of non-compliance documented in the environmental monitoring reports.

Training and competence are essential to the effective implementation of the CESMP(s). Training and competencies must be split to reflect competency requirements for designers, managers, engineers and workers. Training materials must be submitted to ACWA Power for review and approval to ensure its adequacy.

The Construction Environment and Social Manager must establish the Environmental/Social training programme schedule, and must be responsible for:

- The development of training materials or the oversight of the preparation of such material by a competent person in order to effectively conduct environmental and social training;
- Development of an environmental and social training programme;
- The preparation and updating of the schedule for environmental and social training;
- Carrying out environmental and social training for site personnel in accordance with this procedure;
- Training the Sub-contractor's nominated trainers; and
- The collation and retention of training records.

All site personnel must attend and participate in the scheduled training sessions, as applicable. Arrangements must be made which allows the Contractor to identify each individual who has successfully completed the required training. Those who cannot be identified must not be allowed to work on site.

Arrangements must also be made to ensure that, at the start of each week's work, all workers participate in a toolbox talk with their supervisor. Records must be kept for auditing purposes.



Guidance on how to present the talks must be prepared by the Environmental and Social Manager and issued to those giving the talk.

18.7.1 Site Induction

All employees and sub-contractors must be inducted prior to commencing work on the site.

The environmental and social component of the induction will be conducted by a suitably trained person and will focus on the role of AR-SIPVPP Framework CESMP and Construction Contractors' CESMP(s) in achieving good environmental performance. As a minimum, this training will include the following topics:

- Construction Contractor's Environmental and Social Policy and Environmental Management System;
- Legal requirements and other site-specific obligations as they apply to emissions, discharges and wastes handling;
- The key environmental aspects identified for the works such as air emissions, dust, hazardous materials handling, waste management, housekeeping, spill prevention and incident management, energy and resource usage and excessive noise generation and their associated impacts;
- Addressing grievances from workers and other applicable stakeholder in accordance with the Construction
- Contractor's approved grievance mechanism;
- Summary of the measures and practices to be followed to minimize environmental and social impacts;
- Roles and responsibilities of key personnel for environmental and social matters; and
- Potential emergencies and how to respond to them.

The induction will use visual presentations, discussions and a guide booklet and will be conducted in English, Arabic, and other languages as required. Inductees will be required to demonstrate their understanding of the induction contents by correctly responding to a series of multiple-choice questions at the end of the induction. A signed record of each induction must be maintained on site.

18.7.1.2 Environmental and Social Training for ACWA Power- AR-SIPVPP and Construction Contractor Leadership Team



Environmental/Social training must be provided for ACWA Power- & Contractor staff involved in project activities and to construction contractor's senior staff. This training must include topics related to overall project environmental, social and sustainability goals, site environmental controls measures that will be implemented and reporting programme in addition to general site and project environmental requirements. With respect to the social aspects of the Project, training will be provided on the appropriate way to interact with the community for various scenarios.

18.7.1.3 Environmental Training for Construction Supervisor

Selected site supervisors who oversee critical activities or activities with relatively higher potential for environmental impacts or incidents must be provided with specific training to understand AR-SIPVPP Framework CESMP and Construction Contractors' CESMP(s) requirements and good site environmental practices. As a minimum, this must include personnel who will be supervising the following works:

- Chemicals/ Fuel/ Hazardous materials storage and handling, and spill response;
- Waste Management (including sewage and another wastewater); and
- Worker's welfare.

18.7.1.3 Toolbox Talks

Toolbox Talks (TBTs) or environmental briefings related to project task-specific environmental aspects will be given to concerned employees undertaking such tasks where required to assist personnel to carry out their required tasks. This training will be carried out by the Environment/HSE team.

TBTs will be conducted with the employees carrying out the work during the Project on various aspects of the CESMP(s) and control measures that may be required for particular construction activities. They must be carried out on a weekly basis, before the commencement of the day's site activities.

Additional TBTs must be given where a particular environmental issue has been identified as a problem during site inspections or audits. The following topics will be covered for TBTs.

- Hazardous substances handling;
- Waste management;
- Spill control and emergency response;
- Refuelling;
- Dust and air emissions control;



- Noise control;
- Use of materials/ natural resources;
- Wastewater handling; and
- Incident reporting.

18.7.1.4 Emergency Response Training

To ensure the effectiveness of the Emergency Response Team, training will be arranged to ensure they are competent to respond to an environmental incident. The training will take account of site-specific requirements. Spill related mock drills will be carried out at least every two months during the construction project. The Environment Manager or his appointed Emergency Response Team Leader will be responsible for implementing the emergency response exercises

18.7.2 Environmental Regulations and Requirements

18.7.2.1. National Requirements-Kingdom of Saudi Arabia Legislation

The main piece of legislation relating to the environment is the General Environmental Regulations (GER) and the Rules for Implementation (Presidency of Meteorology and Environment, 2001).

1 The environmental regulations as stated in the GER of 2001 comprise the following:

- Articles 1-18 describes the roles and responsibilities of NCEC and the licensing agencies, requirements for new and existing facilities, requirements for compliance with standards and protection of the environment and fines and penalties.
- Environmental Protection Standards namely for Ambient Air Quality, Point Source Emissions and Wastewater
- Pre-Treatment and Direct Discharge Standards and Receiving Water Guidelines (Annex 1 of the GER).
- Basis and Procedures for Environmental Evaluation of Developmental and Industrial Projects (Annex 2 of the GER).
- Manual of Environmental Rehabilitation Procedures details the various environmental activities (services) that require certification from NCEC (Annex 3 of the GER).
- Rules and Procedures for Hazardous Waste Management (Annex 4 of the GER).
- National Contingency Plan for Combating Marine Pollution by Oil and Other Harmful Substances (Annex 5 of the GER).
- Types of Contraventions and Nature of Fines (Annex 6 of the GER).



This legislation forms the basis of environmental management and controls within the country. In 2012-2014, NCEC published a series of updated Environmental Standards in support of the aims of the GER. These include:

- Material Recovery and Recycling of Waste.
- Mobile Source Emissions.
- Noise Standards.
- Point Source Emissions.
- Storage and Material Reclamation Facilities - Design and Operation.
- Thermal Treatment and Incineration – Design and Operation.
- Waste Acceptance Criteria.
- Waste Classification.
- Drinking Water Quality.
- Biological Treatment – Design and Operation.
- Waste Regulatory Control and Compliance.
- Waste Handling and Storage.
- Waste Training and Assessment of Technical Competence of Operators.
- Waste Transportation.
- Best Practicable Environmental Option for Waste Disposal.
- Industrial and Municipal Wastewater Discharges.
- Ambient Air Quality.

A. Air Quality Standards

Table 3-1 presents the NCEC standards for Ambient Air Quality. Additionally, the International Finance Corporation (IFC) general EHS guidelines on ambient air quality require that pollution should not exceed national standards. The IFC EHS guidelines also recommend that emissions must not result in a degradation of more than 25% of the relevant air quality standards.

The national standards set by NCEC will therefore be used to assess air quality within the Project area.

Table 18-4: Ambient Air Quality Standards

Pollutant	Averaging Time	NCEC Standards		
		Concentration		Permitted Allowances
		Pg/Nm'	ppb	



Sulphur Dioxide – SO₂	One Hour	730	280	2 times per annum
	24 Hours	365	140	1 time per annum
	Annual	80	30	N/A
Hydrogen Sulphide – H₂S	One Hour			
	24 Hours	150	100	10 times per annum
	Annual	40	30	N/A
Nitrogen Dioxide – NO₂	One Hour	660	350	2 times per 30 days
	8 Hours	100	50	N/A
Carbon Monoxide - CO	One Hour	40,000	32 ppm	None
	8 Hours	10,000	8.1 ppm	None
Ozone – O₃	One Hour	235	120	2 times per 30 days
	8 Hours	157	80	2 times per 7 days
Fine particulate matter (PM₁₀)	24 Hours	340		24 times per annum
	Annual	80		N/A
Fine particulate matter (PM_{2.5})	24 Hours	35		24 times per annum
	Annual	15		N/A

B. Noise Standards

The relevant NCEC (2014) standard for noise provides permissible noise levels (below) and relates to the following:

- Community noise.
- Noise from industrial units in areas set aside primarily for industrial facilities.
- Noise from construction activities.
- Noise from vehicles.
- Noise from equipment used outdoors.

The applicable standards for noise as per designated areas is provided in Table 2-2 to Table 2-5.

The noise levels within the standard are based on measurements taken at a noise sensitive property within the designated area.

Table 18-5: Applicable Noise Limits

Designation	Day	Evening	Night
	LAeq, (dB)	LAeq, (dB)	LAeq, (dB)
A – Sensitive	50	45	40
B – Mixed	55	50	45
C – Non-Sensitive	60	55	50



Maximum Permissible Façade Noise Limits for General Construction Activities

A, B, C	75	65	45
D	80	80	80

A: Quiet areas, B: Sensitive areas, C: Mixed areas, D: Non-Sensitive areas

Table 18-6: Maximum Permissible Sound Power Limits for Equipment for Use Outdoors

Type of Equipment	Permissible Sound Power Level(dB/1 pW)	Guideline Sound Power Level (dB/1pW)
Compaction machines (vibrating rollers, vibratory plates, vibratory rammers)	108	105
	109	106
	89+11 lg P	86+11 lgP
Tracked dozers, loaders, and excavator-loaders	106	103
	87+11 lg P	84+11 lg P
Excavators and winches, hoists and motor hoes	96	93
	83+11 lg P	80+11 lg P
Tower cranes	98+lg P	95+ lg P
Welding and Power generators	97+ lg Pel	95+ lg Pel
	98+lg Pel	96+lu Pel

Table 18-7: Maximum Permissible Free Field Noise Levels

Area Classification	Daytime LAeq, T 1 2h (dB)	Evening LAeq, T 1 2h (dB)	Night-time LAeq, T, 12h (dB)
A3: Light industrial/residential	55	50	45
A4: Medium density industry	65	60	50
A5: High density industry	75	65	55

C. Soil Standards

Table 18-8: Dutch Soil Standards

Contaminant	Target Value (1) (mg/kg dry soil)	Intervention Value (2) (mg/kg dry soil)
Metals		
Antimony (Sb)	3	22
Arsenic (As)	29	76
Barium (Ba)	160	(2b) 625
Beryllium (Be)	1.1	(2b) 30
Cadmium (Cd)	0.8	13
Chromium (Cr)	100	(2b) 380
Chromium III	---	180
Chromium IV	---	78
Cobalt (Co)	9	190
Copper (Cu)	36	190



Lead (Pb)	85	530
Mercury (Hg)	0.3	(2b) 10
Mercury inorganic	---	36
Mercury organic	---	4
Molybdenum (Mo)	3	200
Nickel (Ni)	35	100
Selenium (Se)	(1a) 0.7	(2a) 100
Silver (Ag)	---	(2a) 15
Vanadium (V)	(1a) 42	(2a) 250
Zinc (Zn)	140	720
Organic Compounds		
Total Petroleum Hydrocarbons(3)	50	5000
Benzene	0.01	1.1
Ethyl-benzene	0.03	110
Toluene	0.01	32
Xylenes	0.1	17
PAH (sum 10/ several)(4)	1	40
PCB (sum 7/ several)(4)	---	1

D. Groundwater Quality Standards

Table 18-9: Groundwater Quality Standards

Parameter	Unit	Concentration Limit	Parameter	Unit	Concentration Limit
Biological Oxygen Demand	mg/l	Not available	Benzene	mg/l	0.005
Chemical Oxygen Demand	mg/l	Not available	Carbon tetrachloride	mg/l	0.005
Total Oil & Grease	mg/l	0	Chlorinated hydrocarbons (total)	mg/l	0.001
TKN (organic)	mg/l	5	Chloroform	mg/l	NA
Total Organic Compounds	mg/l		Cyanide (free)	mg/l	0.001
Phosphorus (total)	mg/l	0.03	Flouride	mg/l	0.2
Phosphorus (PO4)	mg/l	NA	Furans	mg/l	-8 1x10
Ammonia (as NH3)	mg/l	0.03	Hexachlorobenzene	mg/l	0.007
Chloride (as Cl)	mg/l	NA	Lindane	mg/l	0.0002
Total inorganic nitrogen (as No2 & No3)	mg/l	30	Mirex	mg/l	-8 1x10

18.7.2.2 International Standards and Agreements

A.IFC Performance Standards



Table 18-10: Project IFC Performance Standards Applicability

IFC PS No.	IFC Performance Standards	Aim	Project IFC Applicability
1	<i>Assessment and Management of Environmental and Social Risks and Impacts</i>	Underscores the importance identifying Environmental and social risks and impacts and managing environmental and social performance throughout the life of a project.	<i>Applicable.</i> This ESIA meets the Performance standard requirement.
2	<i>Labor and Working Conditions</i>	Recognizes that the pursuit of economic growth through employment creation and income generation should be balanced with protection of basic rights for workers.	Applicable. Although not a central part of The ESIA process, the Project development process itself shall ensure that the requirements of this performance standard are fully understood and the requirements within it are passed into the supply chain. This is included as part of the AR-SIPVPP Worker Health and Safety Plan.
3	<i>Resource Efficiency and Pollution Prevention</i>	Recognizes that increased industrial activity and urbanization often generates higher levels of air, water and land pollution, and that there are efficiency opportunities.	Applicable. Environment and Sustainability has been placed at the center of the AR-SIPVPP development and management of resource efficiency is vital as part of AR-SIPVPP Policy and Principles outlined in this report to which the Project will adhere.
4	<i>Community Health, Safety, and Security</i>	Recognizes that projects can bring benefits to communities but can also increase potential exposure to risks and impacts	<i>Applicable.</i> Positive socioeconomic benefits will be achieved with the development of Project. Risk to future human receptors, and existing as well as future ecological receptors

B. International Agreements

Table 18-11: Summary of International Agreements Relevant to the Project

No.	Agreement Name	Date of Agreement	Summary
1	<i>Agreement for the Establishment for Arab Centre for the Studies of Dry and Barren Land</i>	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.
2	<i>Convention for the Protection of the World Cultural and Natural Heritage</i>	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.



3	<i>Convention on International Trade in Endangered Species of Wild Fauna and Flora and Subsequent Amendments</i>	03/03/1973	Established to identify species at risk and control trade in endangered species
4	<i>International Convention for the Safety of Life at Sea</i>	01/11/1974	Established to protect life at sea and ships -sets minimum safety standards in the construction, equipment and operation of merchant ships.
5	<i>International Convention for the Prevention of Pollution from Ships - Protocol and Annexes I and II and Subsequent Annexes III to VI and All Amendments - MARPOL</i>	17/02/1978	Applied to all ships making international trips and generally, over 400 Gross Tons or carrying more than 15 people. Many aspects are covered including oil pollution but increasingly environmental concerns over ballast, air quality and anti-fouling paints.
6	<i>International Convention on Standards of Training, Certification and Watch keeping for Seafarers and all amendments</i>	07/07/1978	Sets minimum qualification standards for masters, officers and watch personnel on seagoing merchant ships and large yachts.
7	<i>Convention on the Conservation of Migratory Species of Wild Animals and all amendments including MOU on Turtles</i>	23/06/1979	Established to coordinate conservation measures for migratory species. 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. Through linkage with the Convention on Biological Diversity, Saudi Arabia is also required to provide protection to range species of bats under the Eurobat protocol of the CMS.
8	<i>International Plant Protection Convention (1979 Revised Text)</i>	28/11/1979	A convention established to protect the genetic resources of native plant species for agricultural and biological conservation purposes
9	<i>Protocol Concerning Regional Cooperation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency</i>	14/02/1982	Contracting Parties undertake to cooperate in combatting pollution by oil and other harmful substances and maintain and promote contingency plans
10	<i>United Nations Convention on the Law of the Sea</i>	10/12/1982	Includes requirements for environmental protection of marine resources
11	<i>Montreal Protocol on Substances that Deplete the Ozone Layer</i>	16/09/1987	Established to reduce emissions of chemicals harmful to the upper ozone layer

18.7.4. Regulation tracking

Local environmental legislation shall be considered in order to define, analyze and treat environmental aspects during the execution of the project. For this purpose, the HSE Manager shall compile a list of permits required and shall ensure their compliance. This list shall be monitored and reviewed every six months. In case of any modification, it will be included into the appropriate template and distributed to the person responsible on site.



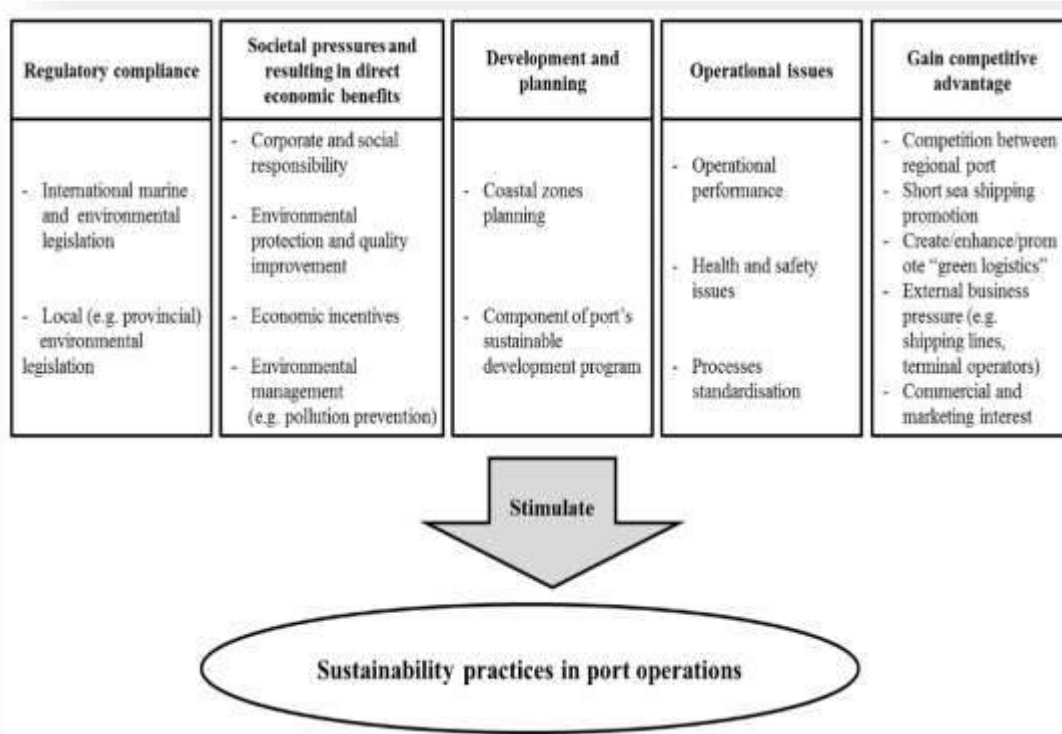
Identification and evaluation of legal requirements and other requirements applicable to AR-SIPVPP Project is included within Environmental and Social Legislation Procedure.

18.7.5 Environmental Commitments

The Owner and Contractors must view this CESMP as a tool reflecting overall commitment to environmental protection. The Owner will demonstrate, through repeated and progressive actions, a firm commitment to meet environmental and health goals and objectives. It is the Owner's responsibility to verify that commitments made to implement mitigation measures and monitoring plans against residual impacts, unexpected releases and other environmental, health and safety issues addressed in this CESMP is met by all Contractors/Subcontractors involved with the AR-SIPVPP Project. This must start at the most senior levels in the organization.

Contractor management must provide strong and visible leadership to promote a culture in which all employees share a commitment to environmental awareness and protection.

18.7.6 Environmental Management and Monitoring during the AR-SIPVPP operations





Organization Chart for AR-SIPVPP Operational Environmental Monitoring



Communication and Environmental Monitoring and Management requirements during AR-SIPVPP operation



- NCEC/MEWA
- Ministry of Energy
- National Centre for Wild Life
- Ministry of Interior

Requirements of Environmental Monitoring

- **Air Quality:** Quarterly monitoring of Air quality for PM 2.5, PM 10, Sox, NO, NO₂, O₃ and VOC's

Environmental Audit

A comprehensive Environmental Audit has to be conducted in compliance with ISO 14001 EMS and the report should be submitted to NCEC for review and approval.



18.8 Mitigation Management Matrix

Note that mitigation measures should be accompanied by a commitment register which is yet to be formulated. The commitments register is a list of mitigation measures which lays out those commitments defined in the Mitigation Management Matrix. If these commitments are not adhered to, mitigation can't be taken into account when defining residual impacts.

18.8.1 Air Quality Control Plan

Soil excavation, materials handling, truck movements on unpaved roads and wind erosion from open stockpiling of dusty materials within the AR-SIPVPP Project Site are identified to be the key dust generating activities. Limited gaseous emissions from generators are expected.

With the implementation of the recommended dust control measures and adoption of good construction site practices, visual checks to ensure adequate implementation of the dust control measures and good site practices throughout the construction and installation period.

The following will be the main impacts identified during construction activities regarding air quality:

- Dust generation
- Gaseous Emissions
- VOC's
- Odour

Impacts on ambient air quality resulting from the construction activities can be controlled through the implementation of the mitigation measures detailed in this section. The mitigation measures proposed generally include control-at-source, management procedures, and the provision of control Structures to limit negative impacts as far as is feasible.



Table 18-4-1 Mitigation Management for the Framework CESMP

A. Air Quality and Odour

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Introduction of new emission sources from vehicles and equipment (e.g. generators) that would likely lead to degradation of the air shed contributing to an increased carbon footprint.	Moderate	Air Quality Climate Stability	International/ Extreme	High	- Implementation of ACWA Power Energy Principle and Greenhouse Gas Emissions Principle. - Embedded mitigation from implementation of the ACWA Power & AR-SIPVPP Transportation Strategy. - Consider inclusion of sustainably sourced fuels. - Standards on Emissions from Mobile Sources (KSA 2020) should be met by all mobile plants such as generators. - The following speed limits shall be enforced within the project site: - 40km/h for light vehicles - 40km/h for heavy equipment/vehicles.	Medium
Degraded air quality from increased dust emissions from construction works such as earthworks.	Minor	National Air Quality Standard	National/ high	Medium	- Ensure that dust emission at the site are minimized by implementing dust control and suppression where required and by ensuring good housekeeping practices. - Vehicles carrying dry earth material should be covered with a tarpaulin or other materials during the entire length of their journey i.e. from source to final location to avoid dust dispersal. - Contractor shall implement appropriate dust minimization and control methods to prevent loss of material through wind erosion as well as dust lift, in line with the best practice, as appropriate for site conditions. This may include, for example, covering stockpiles, limiting stockpiles height, installing fences, wind barriers/physical barriers in the prevailing wind direction where applicable, providing one or more vehicle wash bay with silt trap, etc. - Cover dust sources, such as stockpiles, during dry and windy conditions.	Low



				• All site personnel should be trained to identify activities that generate dust and how best to control it. • The risk of excessive fugitive dust emissions from simultaneous instances of side by side materials handling where risk of excessive dust remains should not be carried out. • Dust generating activities should be suspended during periods of high winds. • Investigation of any complaints and review of equipment against relevant NCEC air quality standards / requirements. Record dust complaints, identify causes and take appropriate measures to reduce dust in a timely manner and record the measures taken. Make the complaints log available to Owner when required. • Record any exceptional incidents that cause dust, either on- or off site, and the action taken to resolve the situation in a logbook. • Hold regular liaison meetings with other construction sites within 500 m of the Project boundary (upon confirmation from A C W A P O W E R) if applicable to ensure plans are coordinated and dust and particulate matter emissions are minimized. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes. • All stockpiles should be covered and protected from wind. In case of long-term storage, the recommended height for a stockpile is 2 m. • All site personnel should be trained to identify activities that generate dust and how best to control it. • No stockpiles should be placed within proximity of the intertidal area. • Internal site roads should be surfaced or compacted or graded, where possible, to reduce dust generation. All construction access roads and service should be well maintained and regularly inspected.	



					Dust suppression of unsealed road surfaces as required by conditions, activities	
Off-gassing from solvents, paints/coatings and similar products used in construction.	Negligible	National Air Quality Standards	National/ high	Low	- Compliance with ACWA Power & AR-SIPVPP Green House Gas Emission Management Policy. - Contractor should procure non-toxic / low-VOC solvents, paints/coatings and similar products, where possible, and store in accordance with requirements of the material safety data sheet (MSDS). - MSDS for all hazardous chemicals shall be kept in dedicated storage area. - Materials with the potential to cause fumes shall be kept in designated storage facilities, with adequate ventilation, air conditioning, and controlled access. - Chemicals which have the potential to react with other chemicals shall be stored separately and in accordance with manufacturer's recommendations.	NS
Emissions to ambient air from fossil fueled mobile machinery, power generation units, vehicles	Minor	National Air Quality Standards	National/ High	Medium	- Implementation of ACWA Power & AR-SIPVPP Energy Efficiency Principle and Greenhouse Gas Emissions Principle. - Inclusion of sustainably sourced fuels, such as organic-based biofuels or clean output fuels such as hydrogen, which will form a critical element of net emissions reduction. - Use of ultra-low sulphur diesel where appropriate. - Implement ACWA Power & AR-SIPVPP Transportation Strategy which strategy requires that transport carriers are maintained regularly and, over time, transitioned toward electric propulsion technologies charged using renewable non-emitting technologies. - During the transition to operations, carriers can use sustainable biofuels as an option. - Standards on Emissions from Mobile Sources (KSA 2012) should be met by all mobile plants such as generators. - Reduce power demands where possible.	Low



					• Careful management of construction activities near sensitive receptors (human and ecological receptors). • Investigation of any complaints and review of equipment against relevant NCEC air quality standards / requirements. • Transportation of materials and workers onto/from site is optimized so that journey distance and number of journeys are minimized. • Site internal roads should be adequately signposted providing clear designated routes for vehicle access. • The following speed limits shall be enforced within the Project site, unless otherwise instructed by the ACWA Power - 40 km/h for light vehicles. - 40 km/h for heavy equipment / vehicles. • No idling of equipment. Equipment should be left idling for more than 10 minutes, unless in an emergency. As per best available technique (BAT), the approximate idling time is 2-4 minutes. • Shut down equipment and machinery or throttle down to a minimum when not being used. • Emissions from stationary equipment should be visually inspected for black smoke with maintenance to follow to ensure required efficiency. • Vehicles/ equipment with excessive exhaust emissions or visible black smoke should be removed from service followed by proper maintenance should be carried out. • Records of all plant and vehicles to be maintained and to be carried out as per manufacturer requirements. • All machinery and equipment should be calibrated and standardized per the timeline approved for it from the competent authority in this field. • Generators and equipment should follow the national standards as set out by NCEC prior to deployment on site and	



					then tested as per manufacturer requirements to ensure compliance with National Emission Standards. • A generator specification sheet including emissions compliance should be obtained from the supplier / manufacturer to ensure emission levels are in compliance with national legislation. The specification sheet should clearly state compliance with national legislation or international standards (if more stringent than national legislation). • Regular maintenance of generators and equipment. • Properly trained and experienced operational and maintenance staff and contractors. • Plant and equipment shall be operated at their optimum rated loads and not beyond their design values. • Any complaints shall be investigated and reviewed against NCEC air quality standards / requirements. Complaints shall be recorded. • Consider inclusion of catalytic converters on generators to reduce emissions.	

B. Noise and Vibration Control Plan

Potential sources of noise impacts during the land-based construction will mainly arise from equipment and machinery required for the proposed works. Traffic generated from operation of the Project is insignificant. With consideration of the low traffic arising from the Project, no traffic noise impacts are anticipated. The following will be the main impacts identified during construction activities regarding Noise and vibration:

- Construction Noise and Vibration
- Construction Vehicle Noise

The potential mitigation measures are control-at-source, management procedures and are detailed in this section.



Table 18.4.2: Summary of Impact and Mitigation Measures – Noise and Vibration

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
introduction of new sources of noise and Vibration emissions in an area currently devoid of noise generating sources.	Minor	KSA national noise standards	National/ High	Medium	- Continuous noise sources (such as generators) to have noise hoarding installed if national ambient noise standards are exceeded. - Locating noise generating components away from habitat, where possible, and design adequate acoustic buffer. - Avoid occurrence of simultaneous high noise activities at intertidal area. - Site inductions and toolbox talks to cover the importance of noise control and available noise and vibration reduction measures. - All machines and equipment which will be used onsite to be calibrated and standardized as per the timeline approved for it from the competent authority in this field. - Ensure machinery and equipment are selected and procured considering low sound pressure / power levels, while meeting the requirements of construction methods. - Employ machinery and equipment that conform to relevant national and/or international standards, directives and recommendations on exhaust gaseous emissions. - Ensure that all noisy equipment including generators are fitted with engine covers, silencers, mufflers and other forms of acoustic linings/attenuators. - Shut down equipment and machinery or throttle down to a minimum when not being used. Prevent idling	Minor



Impacts on workers' health from noise and vibration from vehicular traffic and machinery operation during construction and operations.	Negligible	Workforce	Regional/ high	NS	- Preventive and control measures consistent with good international practice such as in the World Bank Group Environmental, Health and Safety Guidelines and IFC PS2 with measures such as but not limited to: - Provision of a safe and healthy work environment, taking into account inherent risks. - Requirements for health and safety training and awareness creation. - All site personnel must adhere to ACWA Power approved HSE plan and policy requirements in relation to use of appropriate personal protective equipment (PPE) when operating, or in the vicinity of noise generating plant/equipment. - Identify workers who may be exposed to elevated noise levels and brief them of occupational risks from noise exposure. Provide noise reduction PPEs to workers. Respond to any noise related complaints from workers. - Noise and vibration awareness training for all site staff including subcontractors as part of general site induction and toolbox talk activities. - Monitor and report occupational incidents. - Selected personnel working within or near to generator areas must wear appropriate PPE and must spend a specified restricted amount of time in these areas to reduce exposure to excessive generator noise. - Generator doors must remain closed at all times.	NS

C. Soils and Groundwater Management Control Plan

Land based construction activities are anticipated to generate both solid and liquid waste, as well as waste due to a surplus of materials from construction and installation works. However, the waste produced during the construction and installation phase are of small to moderate quantity and will be disposed of accordingly to their nature and relevant regulations, avoiding any potential adverse impact. Mitigation measures are proposed that upon implementation should reduce impacts.



- During construction, waste will be generated during GRP pipe installation.
- Typical construction wastes also include plastic, wood, packaging materials and domestic waste from construction workers. Few hazardous wastes are expected, but may include spent/waste oils for vehicle maintenance, paints and used containers.
- Wastewater during construction will be generated by the workers on site, with the removal of sanitary streams by a licensed contractor.
- Hydro test water will be as waste water before sample test.
- Groundwater will be encountered during any land-based excavation near the coastline. All such areas will require dewatering.

To prevent impacts due to the discharge of hydro test water from pre-commissioning and commissioning activities, the contractor should identify a location for the discharge prior to commissioning activities.

The following impacts will be considered in order to implement mitigation and management measures:

- Spillage/Leakage of hydro test water
- Cross contamination to dewatering topsoil
- Storage and waste management

The following are potential mitigation measures for soil and groundwater impacts.

Table 18.4.3: Summary of Impact and Mitigation Measures – Soil and Groundwater

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Impact on groundwater from dewatering.	Minor	Ground water resources	National/ High	Medium	• Refer to Dewatering Management Plan, the Plan to include method statement to describe in detail the dewatering procedures, including dewatering method, dewatering effluent treatment (if required) and discharge solutions and monitoring plans.	Low



					- Dewatering will be infrequent, temporary and limited. As such, any dewatering will be stopped immediately after excavation has been completed. - No discharge to the environment is permitted. - Dewatering water to be held in temporary holding tanks until tested and then to be used for dust suppression and for non-potable use on site. All dewatered effluent will be tested to ensure compliance. - Dewatering measures will ensure that fines and sediment do not enter the environment. - Dewatering to be kept to a minimum where possible. Monitoring of the ground stability will be undertaken during construction during dewatering activities and for a period post construction. - Use clear warning signs at the dewatering location also use signs for the pipes and cables above or under the ground.	
Improper site stabilization and erosion control.	Minor	Soil physical structure	Regional/ Moderate	Low	- The Contractor shall implement measures to manage soil erosion through minimization of excavated area and preservation of existing ground cover to the extent possible. - Where land-based excavations are made, contractor shall implement appropriate stabilizing techniques to prevent cave-in or landslide. - No stockpiles should be placed within close proximity of the intertidal area and shoreline. - Stockpiles shall be located downwind. - Number and size of stockpiles to be kept to a minimum. - Limiting the height and slope of stockpiles to minimise erosion of unconsolidated materials during rainfall events. - Stabilization measures include plastic sheeting, or similar measures to protect the stockpile from rain and wind erosion.	NS



Physical changes and deterioration of soil quality and cross-contamination from spills or discharge of pollutants / hazardous substances (e.g. fuels/oils, chemicals etc.).	Minor	Chemical status of soils	Regional/ Moderate	Low	- Refer to Hazardous Material Chemicals and Substance Procedures. Provision of spill response equipment such as appropriate spill clean-up kits, absorbent materials etc. should be made available at different locations of the site. - Contractor shall assess their construction procedures to identify and quantify the types and sources of hazardous waste. - Measures shall be followed to avoid spillages. Repetitive handling of hazardous materials shall be avoided. Drip trays and/or bunded mats shall be used to prevent spillages. - On-site maintenance of construction equipment vehicles should be avoided, unless in such cases where equipment could not be transported off-site. If maintenance/ repair on site is required, proper measures to avoid spillage (e.g. use of drip trays and/or bunded mats) will be assured. - Above ground diesel storage tanks will be installed in bunded areas to prevent soil contamination in the event of spillage. The bunds will have a concrete base slab and walls with a minimum height to contain the volume of the storage tank. - Prevent any leakage from the pipeline(s) trenches, holding points, pumps etc. - Any leakage or spills shall be identified and reported. - Ensure proper disposal of sewage waste. - Ensure waste holding tanks are well maintained. Inspect for any leakage. - Ensure welfare facilities including temporary toilets are hygienic and regularly cleaned and emptied regularly to prevent overflow. Always keep septic tanks sealed.	NS



					• Ensure prompt management of spills and appropriate storage of hazardous waste materials in sealed containers. • Ensure workers are provided with adequate PPE. • During land-based excavation a watching brief shall be carried out to identify signs of soil and groundwater contamination (e.g. odour, oil stains). • During concreting works, ensure protection by plastic sheeting to prevent contamination or damage. • Excavated soil for backfill should be verified for any indication of contamination (visual or olfactory signs of contamination).	
Soil compaction due to construction activities such as movement of heavy vehicles and equipment.	Minor	Soil physical structure	Regional/ Moderate	Low	Areas that are likely to be disturbed by construction works should be stabilized as soon as possible. • Land-based excavations will be backfilled, as soon as possible, to minimise soil erosion. • Use of only designated roadways and internal Project roads.	NS

D. Terrestrial Ecology Control Plan

Land-based construction activities (e.g. clearing of vegetation and destruction of habitat from site clearance) can potentially lead to impacts on existing flora, fauna and birds.

The use of artificial lighting on land at night could potentially cause change in behaviour of birds, resulting in their displacement. While the probability of this is low, precautionary mitigation and monitoring measures are provided. ACWA Power Policy should also be adhered to.

The following will be the main impacts identified during construction activities regarding terrestrial ecology:

- Habitat destruction
- Disturbance of fauna

Potential mitigation measures to address potential issues and impacts on terrestrial ecology as a result of construction activities are provided



Table 18.4.4: Summary of Impact and Mitigation Measures – Terrestrial Ecology

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Impact on existing flora and fauna present through construction work activities (e.g. clearing of vegetation and destruction of habitat from site clearance).	Minor	AR-SIPVPP Important Bird and Biodiversity Area	International/ Extreme	Medium	- Workers involved in earthworks will be trained to identify site-specific ecological receptors (e.g. Spiny-tailed Lizards and burrows). - Should sensitive species be noted, ACWA Power should be notified immediately with photos (where possible) taken to identify the species. - If trapping and /or relocation is deemed necessary, it should be carried out by a suitably qualified ecologist. - No capture, handling or intentional disruption of wild animals to occur on site by workers. To be communicated through inductions and toolbox talk sessions.	Low
Increased light levels have the potential to change the behaviour of birds resulting in displacement and therefore, habitat loss.	Minor	AR-SIPVPP Important Bird and Biodiversity Area	International/ Extreme	Medium	- Contractor to raise awareness among operators on how to conduct a visual check for any signs of fauna, particularly around stockpiles or undisturbed grounds. - Site preparation and construction works will need to be carefully managed to avoid significant impacts on existing ecological receptors.	Low
Introduction of invasive species (flora or fauna) – e.g. the <i>Calotropis procera</i> plant, when touched, can cause significant rash and burning of the skin.	Negligible	Site Workers	National/ High	NS	- Clearance works will include the removal of vegetation and a planned strip of surface soil. Stripped soil will either be reused or mulched and reused of in a suitable manner. - Reduce artificial lighting to reduce impacts on birds and mammals during construction. - Avoidance of activities during bird-breeding and nesting season in certain areas. - A strict ‘no approach’ policy to wildlife. - Undertake a check for nesting birds before vegetation clearance (within 48 hours).	NS



Fragmentation and isolation of habitats through insensitive selection of locations for works.	Negligible	AR-SIPVPP Bird and Biodiversity Area	International/ Extreme	Medium	- Minimisation of vegetation clearance and construction working area. - Implement strict controls on waste management during construction to avoid feral cats and rats. - All site workers should be briefed on dangers of <i>Calotropis procera</i> and provided with appropriate PPE for working with or near the plant. ACWA Power shall commence an eradication program for <i>Calotropis procera</i>. - All vehicles should use defined roads to prevent unnecessary impact to the terrestrial ecology. - Ban on driving vehicles off road and outside agreed and approved access routes, work sites etc. - Equipment to be used should be clean and free of soils and potential seed sources from previous site work. - Strict no pet species (cats or dogs) to be introduced or kept at site office, worker accommodation or precast yard. - All night works require approval from ACWA Power. - Contractor should ensure appropriate ACWA Power approval is obtained prior to commencement of night works. - Ensure that illumination on the construction site is minimised. ACWA Power - Dark Sky Policy must be adhered to.	Low

E. Hazardous Materials and Waste Control Plan

Potential mitigation measures relevant to the hazardous materials and waste during construction and activities.



Table 18.4.5: Summary of Impact and Mitigation Measures – Hazardous Materials and Waste

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Inadequate resources and infrastructure to support the Project leading to improper hazardous material and waste management .	Minor	Appropriate management of waste	National/ High	Medium	● Refer to Hazardous Chemical and Substance Materials Management Procedure. Maintain a log / inventory of hazardous wastes and where possible look to substitute / minimize the product or process producing the waste. ● PCBs, asbestos, and ODS management should establish procedures for the proper, identification, handling, and removal of these materials ● Provide bunded storage area or drip trays for hazardous waste. The bunded area will have a capacity to contain at least 110% of the total volume of the largest container. ● Drip trays to be provided for petrol-operated equipment and during handling of chemicals (e.g. at workshops). ● Provide spill kits and fire extinguishers where there is risk of spill and fire, respectively. ● Arrange for regular collection of hazardous waste for offsite disposal by suitably licensed company.	Low

F. Waste Management Plan

Land based construction installation activities are anticipated to generate both solid and liquid waste, as well as waste due to a surplus of materials from construction works and installation. However, the waste produced during the construction and installation phase are of small to moderate quantity and will be disposed of accordingly to their nature and relevant regulations, avoiding any potential adverse impact. Mitigation measures are proposed that upon implementation should reduce impacts, Potential mitigation measures relevant to the waste during construction and activities.



Table 18.4.6: Summary of Impact and Mitigation Measures – Waste Management

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Inadequate waste resources and infrastructure to support the Project leading to improper waste management and impacts on soil and groundwater.	Minor	Appropriate management of waste	National/ High	Medium	- Refer to Waste Management Procedure compliance to the Waste Strategy being developed by ACWA Power, along with the construction waste guidelines if available at the time of construction. - Determine the most appropriate methods for the segregation and storage of waste to ensure waste is presented in the correct manner for upstream treatment. - Allow for recycling, recovery of material and integrated waste collection systems with the supporting infrastructure.	Low
Construction work phase activities will generate both solid and liquid waste. materials. Improper handling and disposal of spoil from land-based excavations. Refuse from workforce (this waste will consist of domestic type refuse such as food wastes, packaging, empty food	Minor	Appropriate management of waste	National/ High	Medium	- Construction waste generation, storage, handling and disposal measures to be detailed as part of the CESMP Waste Management Procedure. The Procedure to also align with ACWA POWER construction waste guidelines (to be made available at the time of or prior to construction). - Achieve diversion rate as per the ACWA Power Waste Management Plan. - Best Management Practices (BMPs) will be implemented to avoid generation of surplus material. This includes adoption of proper procurement planning to avoid waste production and select environment friendly construction materials, associated with less waste production - Avoid stockpiling. Apply only, as and when required techniques. - Spoil from land-based excavation should be reused/ replaced as backfilling material. In case of contamination, soil will be tested. Excess spoil will be reused on other ACWA Power sites as fill material where	Low



and drinks containers, paper etc.) can spread across site and near shore. • Poor management of waste. • Improper management of hazardous waste. • Surplus materials from land-based excavations and construction work materials.					possible. Soil to be reused only after approval by ACWA Power • Spoil storage area should be identified prior to commencement of land-based excavation works. • Provide adequate areas for storage of surplus material. • Excess and residual construction material such as cement, aggregate, concrete, and wood, will be reused onsite as in fill material, whenever possible. • Material that cannot be directly reused on-site will be recycled or recovered off-site. • Maintain inventory control through returns, monitoring and policies. If required, review and change policies to minimise surplus inventory. • Contractor shall assess their construction procedures to identify and quantify the types and sources of hazardous waste. • Utilise reusable or renewable products and packaging materials. • Use of biodegradable alternatives instead of single-use plastics, whenever possible. • Locating all servicing, waste disposal and storage areas as far as possible from the water channels and wastewater channels to reduce the potential of pollution via spillage or windblown debris.	
Inappropriate techniques adopted for the removal of waste (e.g. general or hazardous wastes) may cause odour impacts causing nuisance to workers.	Minor	Appropriate management of waste	National/ High	Medium	• Ensure proper cover/ sealed tops for waste skips/ containers and storage in dedicated areas by individual contractors to prevent and control the dispersion of odour releases. • Contractor to ensure waste segregation at the point of generation along with proper identification, classification and quantification of waste. Ensure waste generated is segregated at the point of generation so as to separate waste which can be reused on site from the waste which needs to be sent to recycle or disposal facility.	Low



Indiscriminate disposal of the general waste in the nearby marine environment may cause water pollution thereby leading to impacts on the ecology.	Minor	Appropriate management of waste	National/ High	Medium	• Provide colour coded bins for proper collection of segregated wastes. • Proper scheduling of waste collection by waste service providers. • Ensure proper cover/ sealed tops for waste skips/ containers and storage in dedicated areas by individual contractors to prevent and control the dispersion of odour releases. • Materials deliveries to the sites should be efficiently planned as coordination between contractors and suppliers in order to avoid the over-purchase of raw materials. • Train and inform all construction workers regarding waste segregation. • Convention dry recyclables such as glass, paper, cardboard, ferrous and nonferrous metals, plastic would be separated into different containers at the construction site. • These containers would be suitably marked and stored, when practicable, in a covered and enclosed area to ensure protection from weather and scavengers. • Containers will be clearly marked and labelled. Labels will be waterproof, securely attached and written in English and Arabic.	Low
Cumulative impact from the potentially large increase in wastes generated from the Project.	Minor	Appropriate management of waste	National/ High	Medium	Contractor will implement all mitigation measures stated above as well as implement measures to ensure effective waste management procedures at all stages of the Project.	Low

G. Archaeology and Cultural Heritage Control Plan

Identifiable archaeological remains or sites of potential cultural interest have not been observed within the project footprint.



Archaeological sites are protected by The Heritage Conservation Act (HCA) of kingdom of Saudi Arabia in which whoever intended to carry out construction activities in area where with possible Archaeological sites must comply with.

- Chance Find Procedure shall be communicated to all site personnel both EPC and subcontractors to understand actions to be taken.
- Potential Impacts to Archaeological Sites
- Construction activities which involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.
- Archaeological and Wildlife Chance Find Procedure and actions

In an event any archaeological materials are encountered, the following procedure / actions shall be implemented immediately:

- All construction activities in the vicinity of the archaeological materials shall STOP immediately.
- The find location will be recorded, and all remains will be left in place.
- ACWA Power and Contractor shall be communicated immediately for site visit and further assessments
- Potential significance of the remains will be assessed and mitigative options will be identified.
- If the significance of the remains is judged to be sufficient to warrant further action and they cannot be avoided, in consultation with ACWA Power Project archaeologist it shall be reported to the government Authority.
- Further actions shall be taken in accordance with directives from the government Authority
- Work shall remain ceased in the area until further communication and directives.
- Wildlife animal shall not be disturbed and would be allowed to move away without any harm.

Potential mitigation measures associated with the current Project are presented in Table.

Table 18.4.7: Summary of Impact and Mitigation Measures – Archaeology and Cultural Heritage

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance



Direct impacts from vibration resulting in loss of buried remains (e.g. graves, wells, other features that are not designated).	Minor	Non - designated sites - including graves	National/ High	Medium	- Requirements of IFC PS No. 8 - Cultural Heritage will be met in case of an archaeological chance find with development of a Chance Find Procedure or Protocol as part of the Construction Environmental Management Plan. Procedure should be detailed to clarify further potential findings of such sites of interest as per requirements from the CMP ESIA: - Ensure that the future design stages do not affect designated sites if any. - In-situ preservation of any archaeological sites identified by fencing-off the site to prevent accidental damage and unauthorized access.	NS
Direct secondary impacts resulting in loss e.g. by compression of buried deposits or impact on unknown finds during land-based excavation activities.	Minor	Non - designated sites - including graves	National/ High	Medium	- Risk of encountering archaeological artefacts during construction works shall form part of site induction for all staff and workers. - Accidental finds to be surveyed by suitably skilled archaeologist.	NS

H. Socioeconomics

The construction and installation stage impacts center around the influx of labour. Due to the facilities and amenities, or lack thereof, required to accommodate the workforce, there is a risk of inflationary pressures due to increases in the demand for food, fuel, housing and land. Due to the population surges, the capacities of social infrastructure such as health care will be stretched. These impacts can be mitigated and reduced. Potential mitigation measures associated with the current Project are presented in Table.



Table 18.4.8: Summary of Impact and Mitigation Measures – Socioeconomics

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Insufficient community services and amenities in AR-SIPVPP to accommodate for the introduction of personnel involved in the project.	Minor	Visitors, residents and site workers	National/ High	Medium	- Provision of adequate community facilities in AR-SIPVPP to meet the needs of the planned worker population. - Provision of adequate accommodation and welfare facilities.	Low
Facilities and amenities required to accommodate the workforce may result in inflationary pressures due to increases in demand for food, fuel, housing and land.	Minor	Saudi National Economy	National/ High	Medium	- All site personnel must adhere to AR-SIPVPP approved HSE plan and policy requirements in relation to use of appropriate personal protective equipment (PPE) and satisfying the requirements of IFC PS No. 2 – Labour Working Conditions. - Ensure that requirements on labour and working conditions adhere to KSA legislation and international best practice requirements (IFC PS 2) are fully incorporated into contracts with contractors and sub-contractors. - Sanitation facilities shall be provided to site workers. All sanitary wastes generated as a result of project activities shall be managed in a manner approved by the relevant government entity within Saudi Arabia. The contractor shall provide a site sanitation plan for approval and implementation prior to the commencement of site activities.	Low
Health and safety risks for	Minor	Site workers	National/ High	Medium	Protect workers, including vulnerable categories of workers such as migrant workers, workers engaged by third parties, and workers in the supply chain.	Low



the workforce involved from physical and chemical hazards or from violation of labour working conditions.					Promote safe and healthy working conditions, and the health of workers; and avoid the use of forced labour.	
Beneficial: The socioeconomic cumulative impact of the Project is considered beneficial as the Project will generate jobs, support the wider AR-SIPVPP project that would increase tourism, etc.	Moderate	Saudi National Economy	National/ High	Medium Beneficial	No mitigation measures are deemed necessary as the impact is beneficial.	Medium Beneficial
Beneficial: Generation of employment during the construction work period.	Moderate	Livelihoods	National/ High	Medium Beneficial		Medium Beneficial

I. Traffic and Transportation Plan

The land-based construction activities will utilize existing roadways and introduce new roadwork's access and internal roads along the transmission pipeline route. The daily transportation of labour from their accommodation in AR-SIPVPP and accommodation to the land based and Project area as well as the frequent use of heavy good vehicles (HGV) for land-based construction and installation materials deliveries will see increase in road traffic impacting the existing traffic and road network in the area. Routes should be designed and planned to be as direct as possible and



construction of temporary access roads should be minimized to lessen the impacts. Below outline the traffic management measures considered for the Project.

Table 18.4.9: Summary of Impact and Mitigation Measures – Traffic and Transportation

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Impacts to existing traffic and transport network.	Minor	Communities Near AR-SIPVPP	Regional/ Moderate	Low	- Refer to Transportation Management Plan. - Routes should be designed and planned to be as direct as possible and construction of temporary access roads will be minimised. - Roads should be well sign posted. - Use of agreed transport routes to site. - All vehicles should be inspected regularly and should be clearly marked as Contract Vehicles, with contact number. - When going through residential areas, including AR-SIPVPP, truck speed should be restricted to 40 km/hr and trucks should not pass through towns during peak traffic hours. - Co-ordinate traffic movements to avoid congestion or queuing at site entrances or on public roads to include dispatching systems, vehicle holding areas, allocated time slots, co-ordination between contractors.	NS
Transport of workforce to and from their accommodation in AR-SIPVPP and frequent use of HGVs leading to	Minor	Site workers	National/ High	Medium	- Traffic should keep to designated routes. Roads should be well sign posted. - All drivers should be trained in road and traffic safety, in order to improve driving standards and appropriate licensing of drivers.	Low



decreased road safety.					• Trip durations should be capped to prevent excessive driving times and driver exhaustion e.g. driver rosters should be formulated. • Speed control devices should be fitted to all vehicles and monitoring of driver actions should be undertaken remotely, where possible. • Communication and training amongst first aid workers to ensure that any traffic related incidents are effectively and efficiently dealt with. • Safety requirements for vehicles, minimum standards and inspection regime. • Marshalling and traffic signs on site. • Trucks should not travel in convoy. • All near misses should be reported.	

J. Dewatering Management Plan

Table 18.4.10: Summary of Impact and Mitigation Measures – Dewatering

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Dewatering during excavation	Minor	Effluent status	Regional/Moderate	Medium	• Dewatering will be discharge to an approved location. • Reuse treated effluent where possible, e.g. dust suppression. • Treat the effluent before discharging, e.g. sedimentation	NS

K. Water Management Plan

Table 18.4.11: Summary of Impact and Mitigation Measures – water management

Description	Impact Magnitude	VER No. And Description	VER value/ Sensitivity	Pre-Mitigation significance	Mitigation measures	Post-Mitigation Significance
Water management	minor	Status of water consumption	Regional/Moderate	Low	• Good practices that would be adopted and implemented to minimise water losses and ensure efficient use of water resources during the construction activities	Low



				- Check all water-using appliances, equipment, and other devices for leaks. - Improve utilization, recycling and reuse of water e.g. sprinkling water, green water.	

M. Workers Welfare Plan

IMPACT/SOURCE	MITIGATION AND MANAGEMENT MEASURES
Occupational Health and Safety	- Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. - The EPC Contractor will implement and maintain an OHS management system taking into account specific risks associated with the project, legal requirements and duty of care. - The EPC Contractor will be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system will be in-line with recognized international best practice and as a minimum, this plan will include: - Means of identifying and minimizing, 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 minimize risks, and requiring and enforcing its use. - Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. - Documentation and reporting of occupational accidents, diseases and incidents. - Emergency prevention, preparedness and response arrangements
Workers Conditions- Terms of Employment, Nondiscrimination and equal opportunities, Working Relationships	- The EPC contractor will provide a plan detailing how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. - Employment relationship will be on the principle of equal opportunity and fair treatment, and will not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. - The EPC contractor will not make employment decisions on the basis of personal characteristics, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. - The EPC contractor will document and communicate to all workers their working conditions and terms of employment including their entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity/paternity, or holiday).



			The EPC Contractor will base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to all aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, accommodation, access to training, promotion, termination of employment or retirement, and discipline. <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 in accordance with national law, will not be deemed discrimination.</i>
Workers Labour	Conditions- Forced		- The EPC contractor will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements. - HR policies and procedures will be adapted appropriately to the size of the workforce required for the Project. Policies and procedures must be prepared to demonstrate consistency with the requirements of national legislation and IFC PS 2.
Workers Labour	Conditions- Child		- The EPC contractor will comply with all relevant national laws provisions related to the employment of minors. - In any event, the client will not employ children in a manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. - Young people below the age of 18 years will not be employed in hazardous work and all work of persons under the age of 18 will be subject to an appropriate risk assessment
Workers benefits, conditions of work and retrenchment	Conditions- Wages,		- Wages, benefits and conditions of work offered should, overall, be comparable to those offered by equivalent employers in the relevant region of that country/region and sector concerned. - If the EPC contractor anticipates collective dismissals associated with the proposed project, the EPC contractor will develop a plan to mitigate the adverse impacts of retrenchment, in line with national law and good industry practice and based on the principles of 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 in order to mitigate adverse effects of job losses on the workers concerned. The outcome of the consultations will be reflected in the final retrenchment plan.
Workers Chain	Conditions- Supply		The Contractor will devise a supply management system to ensure the measures above are implemented by any sub-contractors.



N. Monitoring Program

It is necessary to monitor the impacts of the Project as part of the CESMP from construction till commissioning to provide early warning to unforeseen deviations in expected impact levels. The magnitude of the impact will be assessed and compared with national standards whereby appropriate mitigation measure could be taken accordingly. The weekly environmental monitoring shall include NCR closeout, CESMP required records, training and TBT, materials management and the following environmental aspects:

Table 18.4.13: Summary of monitoring program

Key impact	Action item	Monitoring time frame	Responsibility
1 Air Quality			
Dust	Water sprinkling for haul road, and excavation work.	Daily	HSE Officer
	Vehicle load transport dusty materials to, from site should be covered.	Daily	HSE Officer
	Excavation and transfer soil should be restricted on heavy windy day.	Daily	HSE Officer
	Height of stockpile should be limited to minimize erosion. Dusty materials stockpile should be covered.	Daily	HSE Officer
	Vehicle shall be restricted speed limit 40km/h at work site.	Daily	HSE Officer
	Movement of vehicles should be restricted to designated traffic routes. Road condition should be checked.	Daily	HSE Officer
	Dust generation work should be suspended during high winds.	Daily	HSE Officer
Exhaust fumes	Organic based bio fuel or clean fuels required shall be used.	Weekly	HSE Officer
	Visual inspection of vehicle / equipment exhausts	Daily	HSE Officer
	Minimize unnecessary idling of construction machinery/vehicles	Daily	HSE Officer
	Supervise cleaning vehicle dust filters	Weekly	HSE Officer
Volatile emission	Proper storage of volatile fuel and chemical in sealed containers at dedicated storage area.	Daily	HSE Officer
	Materials with potential to cause fumes shall be kept in storage facilities, with adequate ventilation, and access control.	Weekly	HSE Officer
Odour	Sanitary facilities should be inspected	Daily	HSE Officer
2 Noise and vibration			



Noise	Monitor site noise generating.	Weekly	HSE Officer
	Hearing protection used by workmen	Daily	HSE Officer
	Equipment /vehicle fitted with silencers, covers and regularly maintained	Weekly	HSE Officer
	Shut down equipment and machinery when not being used.	Daily	HSE Officer
Vibration	Areas likely to be affected, and near sensitive receptors	Daily	HSE Officer
3 Soil and groundwater			
Soil Contamination	Washing of equipment, machinery and vehicles will only be permitted in designated areas	Weekly	HSE Officer
	Concrete wash out area	Bi-weekly	
Top soil	Top soil removed to demarcated storage location	Weekly	HSE Officer
Stabilization and erosion	Stockpiles located downwind far from shoreline. Number and size of stockpiles to be kept to a minimum.	Daily	HSE Officer
Dewatering management	Dewatering shall be stopped after excavation and erection work completed.	Daily	HSE Officer
	Dewatering water to be held in temporary holding tanks.	Daily	HSE Officer
	Dewatered effluent will be tested to ensure compliance.	Daily	HSE Officer
	Ground stability shall be checked.	Daily	HSE Officer
4 Terrestrial ecological			
Flora and fauna	Identification of presence of sensitive flora and fauna on site. Awareness among operators on how to conduct a visual check for any signs of fauna, particularly around stockpiles or undisturbed grounds.	Prior to construction Weekly	HSE Manager
Disturbed area	Disturbed areas will be monitored weekly to ensure the effective rehabilitation and restoration of the affected areas.	Weekly	HSE Manager
Light levels change the behaviour of birds.	Reduce artificial lighting to reduce impacts on birds and mammals during construction. Approval is obtained prior to commencement of night works.	Weekly	HSE Manager
5 Hazardous Materials and waste			
Hazardous liquid materials	Bunded storage area or drip trays for hazardous waste.	Daily	HSE Officer
	Spill kits and fire extinguisher provided	Weekly	HSE Officer



Hazardous materials and waste management	PCBs, asbestos, etc hazardous materials and waste identified with signage, proper store, disposal by licensed company.	Weekly	HSE Manager
6 Waste Management			
Waste Management	Monitoring of the Waste segregation and storage.	Bi-weekly	HSE Manager
	Assign designated area for temporary waste storage. Provision of adequate waste collection and storage facilities.	Prior to construction Monthly	Construction Manager
	Provide adequate areas for storage of surplus material.	Weekly	HSE Officer
	Update waste management log sheet	Weekly	HSE Officer
	Quantities and types of waste taken off site	Weekly	HSE Officer
	Estimates of the quantities and types of waste recycled, reused, or recovered	Weekly	HSE Manager
	Review documents of authorized companies for waste removal	Yearly	HSE Manager
7 Archaeology, Cultural Heritage and wildlife			
Archaeology, cultural heritage and wildlife	Identification of presence of archaeology, cultural heritage and wildlife within project boundary Accidental chance finds to be surveyed.	Prior to construction Weekly	HSE Manager
8 Socio-Economics			
Accommodation	Adequate community facilities in AR-SIPVPP to meet the needs of the planned worker population.	Monthly	HR Manager
	Verify Identity information with local municipality to confirm local recruitment statistics	Monthly	HR Manager
	Interviews and surveys will be conducted with workers to understand the effectiveness of the recruitment process	Monthly	HR Manager
Labour and Working Conditions	Monitoring of Labour Working conditions Interviews and surveys will be conducted to assess status of working conditions	Weekly	HSE Manager
	Inspections of the accommodation	Weekly	HSE Manager HR Manager
	Labour working hours and overtime, on-time wages and benefits payments	Monthly	HR Manager
9 Traffic and Transportation			
Transportation at site	Roads should be well sign posted.	Weekly	HSE Officer
	Road conditions shall be regularly repaired and maintained.	Weekly	HSE Officer



	Truck speed should be restricted to 40 km/hr and trucks should not pass through towns during peak traffic hours.	Weekly	HSE Officer
	All vehicles should be inspected	Weekly	HSE Officer
Workforce transportation	Use of agreed transport routes to site.	Weekly	HSE Officer
	Trip durations should be capped to prevent excessive driving times	Weekly	HSE Officer
10 Dewatering management			
Effluent from dewatering	Monitoring of effluent quality at the discharge point	Weekly	HSE Manager
	Visual inspection of dewatering effluent for signs of contamination, e.g. oily sheen, foam or odour prior to reuse or final discharge.	Daily	HSE Officer
	Visual observation for any visible oil or suspended solid prior to discharge onsite or disposal offsite.	Daily	HSE Officer
11 Water management			
Water Conservation	Water conservation and the statistics	Monthly	HSE Manager
	Inspection of water consumption maintain and repair if it found with defects.	Weekly	HSE Officer
	Analysis statistic of water consumption, identify unreasonable consumption	Monthly	HSE Manager
	Hydro testing water shall be reused for different pipe section.	Weekly	HSE Manager
	Qualified water will be used for dust suppression	Weekly	HSE Manager

O. Training Program

Environmental training will be provided to all staff, own or outsourced, affected by the operational control of the project. This training will include at least the following points:

- Environmental Management Systems. Reasons, meanings and benefits.
- Environmental Aspects. Definition and identification of the significance of the site/plant.
- System Objectives and Goals.
- Operational control of the construction work.
- Basic notions of System Documentation.
- Waste management. Types of wastes and their correct management. Correct storage of wastes
- Accident and Environmental Emergency Response Plans.
- Organization and cleaning of the site/plant.



The training will be given by the HSE Manager or trainer for the project at the entrance of the staff to the site by environmental inductions, specific induction of supervisors, specific training, toolbox talks etc. List in the table:

Table 18.4.14: Summary of training program

Training Topic	Training Contents	Trainees
Dust control Management	Dust control plan: • Traffic management • Excavation and soil stockpile management • Dust suppression records	Supervisors and specific appointed personnel,
Waste Management Hazardous Waste Management	Waste management procedures: • Waste disposal and segregation • Waste storage • Waste collection and transport • Waste destination • Waste records	Supervisors and specific appointed personnel, with specific role in the waste management
Dewatered Effluent and Hydro testing Management	• Effluent storage and disposal requirements • Effluent re-use criteria • Related record keeping	Supervisors and specific appointed personnel, with specific role in the dewatering and hydro testing
Chemicals Storage, Handling and Use	• Chemicals hazards and risks • Chemicals labels and symbols • Material Safety Data Sheet • Chemicals storage • Chemicals handling • Chemicals use	Supervisors and specific appointed personnel, dealing with chemicals
Chance Find Procedures	• Chance find producers or protocol for archaeological features onsite • Communication procedure in-case of finding features onsite. • Flora and fauna identification.	Supervisors and specific appointed personnel

Such environmental training, will be given if it is estimated necessary, to ensure the implementation and monitoring of the Environmental Management System.

The training attendance sheet must be completed for all training sessions and includes:

- Training module name; date; location; presenter's name.
- Trainee's details: name, company, position and signature.

A Training Register should be maintained by the Contractor. The Training Register will be developed in order to allow the training history of any employee to be quickly checked.

P. Community

The mechanisms used to address the Environmental Grievance relating to our construction activities are described in "Grievance Procedure"



Table 18.4.15: Summary of community management

IMPACT/SOURCE	MITIGATION AND MANAGEMENT MEASURES
Occupational Health and Safety	- Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. - The EPC Contractor will implement and maintain an OHS management system taking into account specific risks associated with the project, legal requirements and duty of care. - The EPC Contractor will be responsible for ensuring that all affiliated sub-contractors comply with the OHS management system. The OHS management system will be in-line with recognized international best practice and as a minimum, this plan will include: - Means of identifying and minimizing, 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 minimize risks, and requiring and enforcing its use. - Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. - Documentation and reporting of occupational accidents, diseases and incidents. - Emergency prevention, preparedness and response arrangements
Workers Conditions- Terms of Employment, Nondiscrimination and equal opportunities, Working Relationships	- The EPC contractor will provide a plan detailing how working conditions and terms of employment are compliant with national labour, social security and occupational health and safety laws. - Employment relationship will be on the principle of equal opportunity and fair treatment, and will not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. - The EPC contractor will not make employment decisions on the basis of personal characteristics, such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation, unrelated to inherent job requirements. - The EPC contractor will document and communicate to all workers their working conditions and terms of employment including their entitlement to wages, hours of work, overtime arrangements and overtime compensation, and any benefits (such as leave for illness, maternity/paternity, or holiday). - The EPC Contractor will base the employment relationship on the principle of equal opportunity and fair treatment, and will not discriminate with respect to all aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and



	terms of employment, accommodation, access to training, promotion, termination of employment or retirement, and discipline. <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 in accordance with national law, will not be deemed discrimination.</i>
Workers Conditions- Forced Labour	- The EPC contractor will not employ forced labour, which consists of any work or service not voluntarily performed that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements. - HR policies and procedures will be adapted appropriately to the size of the workforce required for the Project. Policies and procedures must be prepared to demonstrate consistency with the requirements of national legislation and IFC PS 2.
Workers Conditions- Child Labour	- The EPC contractor will comply with all relevant national laws provisions related to the employment of minors. - In any event, the client will not employ children in a manner that is economically exploitative, or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. - Young people below the age of 18 years will not be employed in hazardous work and all work of persons under the age of 18 will be subject to an appropriate risk assessment
Workers Conditions- Wages, benefits, conditions of work and retrenchment	- Wages, benefits and conditions of work offered should, overall, be comparable to those offered by equivalent employers in the relevant region of that country/region and sector concerned. - If the EPC contractor anticipates collective dismissals associated with the proposed project, the EPC contractor will develop a plan to mitigate the adverse impacts of retrenchment, in line with national law and good industry practice and based on the principles of 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 in order to mitigate adverse effects of job losses on the workers concerned. The outcome of the consultations will be reflected in the final retrenchment plan.
Workers Conditions- Grievance Mechanism	The EPC contractor will provide a grievance mechanism for workers to raise reasonable workplace concerns. The client will inform the workers of the grievance mechanism at the time of hiring, and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides feedback to those concerned, without any retribution. The mechanism should not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.



**Workers Conditions-
Supply Chain**

- The Contractor will devise a supply management system to ensure the measures above are implemented by any sub-contractors.

Q. Environmental Auditing

The CESMP is likely to be audited both internally and externally. The process of audits is established in the internal procedure of audits management.

Non-conformities, corrective Actions and preventive Actions

Environmental non conformities, corrective and preventive actions are managed by following conditions within the internal procedure of problems and improvement actions management.

The objective of this procedure is to establish a system for the documentation, analysis and satisfactory treatment of non-conformities and customer claims observed in the tasks performed, and prevent non-conforming products or services that may be used or installed inadvertently. Additionally, it describes the methodology for the implementation of corrective and preventive actions as well as ideas/suggestions to promote continuous improvement and ensure an adequate customer service. Environmental Incidents may involve oil spills/leaks, accidental events, damage to flora/fauna, contamination of groundwater, noise exceedance, noticeable odour, impacts to sensitive area/habitat, regulatory permit exceedances, visual/physical pollution, public complaint and other unplanned environmental events. The environmental incidents have been classified into different tiers according to their significance:

Table 18.4.16: Tier of non-conformities

Tier	Definition	Example
Tier A: Major	A non-conformity that could result in a high or medium pollution incident or involves a breach in legislation, or a repeated occurrence of a minor non-conformity that has been raised in the past.	Un-containable or uncontrollable spills • Excessive uncontrollable incidents which will re-occur to cause danger, nuisance, numerous complaints or significant impacts • Significant loss of biodiversity at the site which will re-occur to cause impacts to biodiversity
Tier B: Minor	A non-conformity that is not Major but could result in a low-level pollution event	Excessive uncontrollable incidents which are likely to re-occur to cause nuisance or when a complaint is received. • Rectifiable environmental damage and likely to re-occur. • A specific being a small spill of oil which though contained and cleaned using spill kit results in contamination of the immediate soil environment
Tier C: Observations / Near Misses	This is not strictly a non-conformity but a minor event where procedures have not been followed fully	Small, containable spills on land within the site boundary. • Minor nuisance but controllable and preventable from re-occurrence. • Minimal environmental damage but controllable and preventable from re occurrence.



In the event of Tier, A, B or C environmental incidents, an Environmental Incident Report Form should be completed.

The Environmental Coordinator is responsible for ensuring that the Environmental Incident Form is correctly completed for all incidents. The Environmental Incident Form includes details on the following:

- Details of the contractor / sub-contractor / witness responsible for reporting the incident.
- Date of the incident.
- Condition on site during the incident.
- Description of location of the incident.
- Cause of the incident.
- Scale of the incident.
- Potential impacts of the incident.
- Describe the non-compliance with reference to the CESMP.
- Proposed corrective actions.
- Person responsible for corrective action.
- Signature upon completion.

Management of accidents, incidents, corrective and preventive actions shall be managed by EPC Contractor.

Environmental non conformities are considered the following:

- When a written complaint is received from the client.
- Failure to comply with the requirements specified in the Environmental Management System detected in internal and external audits.
- In case of sanctions/penalties related to the environment.
- In the event of legal or contractual non-compliances related to environmental issues.

Any person may detect non-conformities, accidents or incidents in a product or works regarding quality, environmental and occupational health and safety requisites. The detection may be made during a process or once it has finished, through observations, verifications or during the inspections and tests planned in the procedures and instructions of each task. The person who detects a non-conforming element or work shall communicate it and record it.

R. Environmental Reporting

Daily Inspections



Daily checks are informal inspections intended to observe workers' activities and visually assess onsite implementation of mitigation measures. Daily checks will be conducted by the Contractors and records of daily checks, in case any observation is made, shall be maintained on site.

A site walkover inspection should be conducted and documented daily by the HSE Manager. The purpose of the check is to ensure continued good environmental housekeeping at the site and compliance with the CESMP.

An Environmental Inspection Record should be completed during each daily inspection. These will be documented, reviewed and submitted to the Project Director. The inspection will cover as a minimum:

General site housekeeping	Noise
Dust and air quality	Soil contamination
Materials management	Waste management
Ecological observations	Archaeological chance findings
Training and TBT needs	Hazardous material storage conditions
Water management	Illumination management

Weekly Inspections

Formal site inspections shall be carried out on a weekly basis. These weekly inspections shall be carried out jointly between the Contractor and Owner. The objective is to allow the Contractor to identify non-conformities and evaluate implementation of CESMP requirements on a more frequent basis. Weekly walkover inspections should be conducted and documented by the Environmental Coordinator. The purpose of this inspection is to ensure compliance with the CESMP. An Environmental Inspection Record should be completed during each inspection. These will be documented, reviewed and submitted to the Project Director.

The inspection will cover as a minimum:

General site housekeeping	Noise
Dust and air quality	Soil contamination
Materials management	Waste management
Ecological observations	Archaeological chance findings
Training and TBT needs	Hazardous material storage conditions
Water management	Illumination management
NCR Close Out and Effectiveness	CESMP Required Records.

Records

Environmental records management will be done according to the internal procedure of Documentation management.

Records of the Environmental Management System are established but not limited to the following:

- Pre-operation compliance reports
- Incident reports



- Weekly/monthly performance reports
- Noncompliance reports.
- Complaints management reports
- Corrective/Preventive actions reports.
- Internal/External Audits.
- Records of internal and external communications.
- Minutes of Management System Committees.
- Evaluation of compliance of legal requirements.
- Records of monitoring and measurement.
- Environmental Training Records.

All these records will be subjected to owner's periodical audit including non-conformities reports.

S. Emergency Plans and Response Capacity

The systematic approach to define the actions to follow against environmental emergencies is included within the Emergency Response and Crisis Management Plan.

This plan is aimed to describe the systematic of EPC Contractor for the treatment of accidents or situations of environmental emergency which might occur during the phase of execution and commissioning of the project, with the purpose of preventing, minimizing or eliminating the associated environmental risks. To this end, specific measures for prevention, control and response to situations and/or accidents which cause significant impact over the environment, such as spills or leaks of diesel fuel or chemical products. In any case, an environmental damage evaluation report must be completed if an environmental accident is produced.

T. Communication

An internal procedure for Communication defines the methodology for the conduction and treatment of communications, both, external and internal related to the EPC Contractor Environmental Management System.

All staff, including subcontractors, will have the responsibility to communicate any potential environmental issues to the direct supervisor, including chemicals spills, excessive waste, excessive dust generation, uncontrolled discharges, suspicion of soil or water contamination, discovery of heritage item, complaint, etc.

It is important that suitable communication among managers, supervisors, workers and subcontractors is maintained throughout the construction and commissioning of the Project.

Formal modes of internal communications, as relevant to the environmental management of the Programme, should include:



- Management meetings.
- Environmental meetings
- Progress meetings (with environment on agenda).
- Monthly reports and other transmittals.

The HSE Manager will assume the role of focal point for discussions with Owner about any modifications to the scope of works, reporting of incidents, identified non-conformances, changes in the Project site boundary, and any other reported environmental issues.

Table 18.4.17: Communication plan

Communication type	Participants	Owner	Description	Frequency
Internal Progress Meeting	Management team including: • Project Director, • Construction Manager • HSE Manager • Subcontractors	Contractor's CM	Update and discussion of project environmental issues and progress.	Weekly
Weekly HSE Meeting	HSE Manager	HSE Manager		Weekly
Communication of impact/ emergency complaint	All teams, including subcontractor	All team	Communication of impact on environment or an environmental emergency or a complaint A discharge, spill or release of a contaminant to soil, ground or air occurring during any kind of activity, etc. must be reported immediately to the supervisor.	Every time impact/ emergency is detected.
Trainings / Tool box talks	All team, including subcontractor	HSE team and supervisor	As defined in the training plan, to promote the integration of the workers and provide essential information regarding environmental issues and procedures.	As per training plan

18.9 Table of Contents of CESMP

18.9.1 Purpose

The Construction Contractors' CESMP is a document used to guide and regulate environmental performance for AR-SIPVPP construction phase specific to each contractor. The CESMP must be



drafted according to each contractor's scope of works accounting for the relevant associated impacts and mitigation measures. The CESMP must accumulate information from various documentation to develop a concise plan that demonstrates environmental monitoring, management and mitigation measures relating to the contractors associated project impacts. Amongst the documentation used to develop the Construction Contractors CESMP include:

- AR-SIPVPP Framework CESMP & ACWA Power Policies;
- Good International Industry Practices (GIIP): International Finance Corporation (IFC) Performance Standard One (1) Assessment and Management of Environmental and Social Risks and Impacts, 2012;
- Monitoring and Mitigation Measures (adapted from specialist findings); and
- Rehabilitation and Management Plans (adapted from specialist findings).



Figure 18-2 Construction Contractors CESMP Framework Composite

18.9.2 Aims

The aims of the overall CESMP should be clearly indicated and link to the objectives. The following aims which relate to the environmental management of the Project are required to be defined within the Construction Contractor's CESMP:

- Deliver the development and works order for ACWA Power in accordance with industry best practice standards and legal requirements;
- Ensure protection of the environment and social sensitivities as well as adherence to the AR-SIPVPP Framework CESMP;
- Defining the roles and responsibilities of all key personnel and outlining, reducing, mitigating the effects of the construction activities; and
- Providing an overview of the QHSE management required and necessary procedures for monitoring, auditing, communication, and documentation of environmental activities.



18.9.3 Scope and Objective

The Contractor is to provide under this section a brief description about the contractor's scope of works in context of the overall Project and applicability of the Construction Contractors' CESMP during construction. In addition to the construction site itself, facilities that the contractor will utilize such as offices and residential areas must also be accounted for in the overall construction impact and footprint (as well as the correlating mitigation and management measures). The CESMP should also refer to working hours, storage and site facilities, security and health and safety.

The Construction Contractors' CESMP must be prepared to address the environmental and social aspects impacts associated with the Project and the mitigations as defined in the ESIA. The objective of preparing the CESMP must be presented.

18.9.4 Ownership and Distribution

The Construction Contractors' CESMP document belongs to the contractor who prepared it specifically for the construction of the project. The distribution list is to establish effective communication channels to enable effective control of environmental and social related matters. The distribution list must identify individuals and organizations that will receive a copy of the Construction Contractors' CESMP for implementation. As a minimum, the Construction Contractors' CESMP must be distributed to ACWA Power, Contractor's key personnel (e.g. Project Manager, Construction Manager, and Environment/Social Manager) and subcontractors.

The Construction Contractor's CESMP should be made available in all site offices with appropriate training and induction. In addition, the review schedule of the document and information that it is a live document should be clearly stated.

18.9.5 Project Description

The Project Description section of the Construction Contractors' CESMP must briefly include information regarding the overall Project and planned mobilization, construction and decommissioning activities, and project schedule and milestones. Wherever relevant, the information for sections 18.11.5.1 to 18.11.5.3 can be developed using guidance from the ESIA. Where any aspect such as planned activities / schedules etc. have changed or differ to the ESIA, these should be updated with the most up to date information

18.9.5.2 Location

The Project area is located in Ar Rass

18.9.5.3 Environmental Management System

18.9.5.4 Policy Statements



This section must present Contractor's commitment to environmental protection, health, safety and welfare management and compliance with applicable regulations. The company policy statement signed by the senior management must be included.

18.9.5.5 Roles and Responsibilities

This section must lay out the chain of command and include the roles and responsibilities of personnel in relation to implementation, management, and review of the Construction Contractors' CESMP. Roles and Responsibilities of the AR-SIPVPP– ACWA Power organization is described in Table 18-1 and that of the Construction Contractors organization is described in Table 18-2. It is the responsibility of the Contractors and Subcontractors to ensure that requirements are contained within the approved Construction Contractors' CESMP and all applicable environmental regulations. This section must also include:

A project organization chart showing the names, positions, and contact information of personnel involved with ensuring the proper implementation of the Construction Contractors' CESMP.

Discuss the roles and responsibilities of all involved parties such as ACWA Power, Contractor, and subcontractors identified and the interrelationships between these entities. Additional details related to specific roles and responsibilities of the Contractor in relation to environmental management must be included for at least the following key personnel:

- Project Manager;
- Environmental/Social Manager;
- Environmental and Social Officer;
- Site Supervisors;
- Emergency Response Coordinator; and
- Site workers.

18.9.5.4 Environmental Awareness Training

This section must include an overview of the Contractor's systematic programme to ensure that employees are aware of AR-SIPVPP Framework CESMP and Construction Contractors' CESMP(s) prescribed environmental/social requirements. The CESMP must define the competency of the training provider, the frequency of training, and the levels of training for personnel. This information must include, but not be limited to, the following:

- A description of the environmental awareness and training programme that will be provided separately for site personnel such as managers, supervisors, subcontractors and construction workers, contractors, and subcontractors which are needed to comply with measures contained within the CESMP(s);



- Identification of training needs, including general knowledge of the CESMP(s) and activity-specific guidance for different activities (e.g., the handling of hazardous waste, operation of certain equipment); and
- Established procedures for maintaining records of all training to be performed, including the name of the person trained, the date of training, the name of the trainer, and a description of the training content.

18.9.5.5 Environmental Mitigations

One of the most important contents of the Construction Contractors' CESMP, the Contractor will develop procedures for managing and mitigating environmental and social risks for the Project, the Contractor will prepare and implement mitigation measures or control plans, which must include, but not be limited to, the elements described in the following subsections. The Contractor must thoroughly address site-specific mitigation measures for the applicable environmental components discussed in following sections. Mitigation strategies must be based on the best available management practices and technologies that will eliminate or minimize adverse impacts to health, safety, amenity, traffic, or the environment in the surrounding area. The CESMP(s) must include measures that will be performed and that can be audited to determine their effectiveness. Mitigation measures can be populated in a table format which includes environmental effects, proposed mitigations, timeframe for implementation, responsibility, associated method statement/plan, and indicator of success/compliance.

Refer section 18.10, for details about mitigation measures that are required. Mitigation measures shall be developed in full consultation with the AR-SIPVPP prior to inclusion in the ESIA.

It should be noted that recommended mitigation measures are provided based on available best practice judgment and knowledge at the time of writing. These are not exhaustive. This, therefore, doesn't preclude alternative measures to be considered by the Contractor. However, any deviations require consent and approval from the relevant Client representative to ensure the output remains aligned to the conclusion of this ESIA.

The following control plans must be developed using the specific guidance from this ESIA and the proposed mitigation measures to be included in the Construction Contractor's CESMP.

18.9.5.6 Air Quality

This section must provide the mitigation measures to be used to minimize air emissions from all construction activities. The plan must discuss procedures for the periodic inspection and routine maintenance of equipment in accordance with the manufacturer's instructions. These procedures



must also include documentation requirements for all inspections and maintenance activities. The following subsections must be included:

- Dust Management;
- Gaseous Pollutants Management; and
- Odor Management.

18.9.5.7 Noise and Vibration

The Noise Management Plan must include control measures to minimize the impacts on local noise levels from the construction activities. The objective is to ensure that ambient noise level concentrations do not exceed established limits for both workers on site and for nearby receptors.

18.9.5.8 Hydrology

Hydrological plans should be implemented which accommodate flood risks, storm water drainage, water supply, wastewater and irrigation. No groundwater extraction is anticipated for the AR SIPVPP activities and good practice construction methods will avoid contamination during works. There are no permanent freshwater bodies in the region around of the AR-SIPVPP Project and all watercourses are non-perennial, typically only flowing for short periods of time following high intensity rainfall events. The natural drainage across the AR-SIPVPP is typically wide and braided due to the flat topography and the extensive alluvial deposits.

18.9.5.9 Visual and Landscape

This section must provide the mitigation measures to be used to minimize visual and landscape impacts. A site survey analysis must be used to define and illustrate landscape character and visual receptors. Further analysis of the Project components should be included identify and optimize the opportunities for embedded mitigations that seek to assimilate the Project into the existing physical fabric of the landscape and retain the most special qualities and scenic elements for the benefit of future users and the environment as a whole

18.9.5.10 Cultural Heritage and Archaeology

Archaeological Monitoring Plans should be implemented during construction. Any historical objects and/or fossils should be reported to the local authority. Find chance monitoring procedures should occur weekly during the construction period

18.9.5.11 Social and Economic

AR-SIPVPP-CW will result in employment opportunities as well as an influx of people into the area which would change the character of the area and lead to pressure on local services/resources, movement patterns, conflict, and competition with the incumbent population. Furthermore,



increased capital expenditure will lead to beneficial downstream impacts on the local and regional economy.

In line with the requirements of IFC PS5 and PS7 – it is recommended that consultation with local communities that may be impacted by the development is undertaken prior to construction work being undertaken. It is understood that there are no affected communities in this is leading this initiative although the details of this consultation are unknown at the time of writing this ESMP.

A livelihood restoration plan will not be required as there are no affected households identified in AR-SIPVPP Project, and how these will be replaced. The Livelihood Restoration Plan should include a fisheries livelihood restoration component, which (a.) confirms the extent and nature of fishing activities / livelihoods, (b.) quantifies the impacts on fisheries and fishing-based livelihoods, (c.) mitigation measures that could be applied across the AR-SIPVPP Project, and (d.) define a monitoring programme for assessing the effectiveness of fishing livelihood restoration, and if necessary to identify the need for additional livelihood restoration measures.

A Local Procurement policy should be developed that defines clear, practicable and measurable mechanisms and milestones for local procurement. Local procurement targets must be incorporated in contractor and sub-contractor agreements.

18.9.5.12 Geology and Soils

The Geology and Soils Plan should outline measures to manage and minimize the impact of the Project on soil and geology. This plan should include documentation of the measures used to ensure that oil and hazardous materials are properly contained to prevent contamination of soil and groundwater. Furthermore, the plan should include preservation of existing geology where appropriate and precautions/management of works undertaken in vicinity of unstable slopes.

- Hazardous materials are properly managed to prevent contamination of soils and geology;
- Soil and rock quality are not reduced through the works, including excavation, storage and reuse of soils and Rock;
- Slope stability is assessed, and appropriate precautions/ management are undertaken in the vicinity of unstable slopes;
- Existing aggressive soils, or dewatering of soils does not create acidic soils, that pose a risk to in ground structures and services, end users or landscaped areas; and
- Ground contamination is identified and assessed to determine if it poses a risk to the Project, and if required mitigation/ remedial measures are implemented.

18.9.5.13 Terrestrial Ecology



The terrestrial ecological management plan (TEMP) must be developed by a suitably qualified ecologist appointed by the Construction Contractor, and must present the control measures that will be adopted to ensure protection of sensitive ecology surrounding the Project site. The Terrestrial Ecological Management Plan (TEMP) needs to cover all AR-SIPVPP-CW which could result in identified potential impacts to sensitive terrestrial receptors as detailed in Section 11 Terrestrial Ecology and the CESMP Mitigation Management Matrix. The Plan will need to specify all required and recommended control measures to be implemented to protect the terrestrial environment. A commitments register must be formulated which provides avoidance, mitigation, and compensation measures as appropriate and measures to be taken must be clear. The commitments register will be adhered to by the Construction Company and will be checked by the Environmental Clerk of Works (or similar) with a clear audit trail.

No-go areas must be included in the plan and all staff must be made aware that access to these areas are expressly forbidden. This section must include the need to provide necessary training to construction staff to refrain from causing any danger to fauna. Mitigation measures must include actions taken to prevent wildlife from entering the construction site such as means of using the appropriate type of fencing. The plan may include provisions for actions to be taken in the event that protected species are encountered (e.g. spiny-tailed lizards) and the prevention of the introduction of alien/invasive species. This may include translocation of known wildlife prior to construction taking place. All translocation should be carried out by a competent ecologist using a detailed and refined method statement including an assessment of the receptor site paying particular attention to the carrying capacity of receptor sites.

18.9.5.14 Waste Management

The Waste Management Plan section should provide information on activities to manage solid waste, liquid waste, and hazardous waste.

Contractors will introduce practices that minimize waste generation at source, by reducing waste and introducing segregation of waste following the principles of the waste management hierarchy. The contractors must nominate waste monitors within the site workforce who will be the point of contact on site for waste matters and who are incentivized to segregate waste.

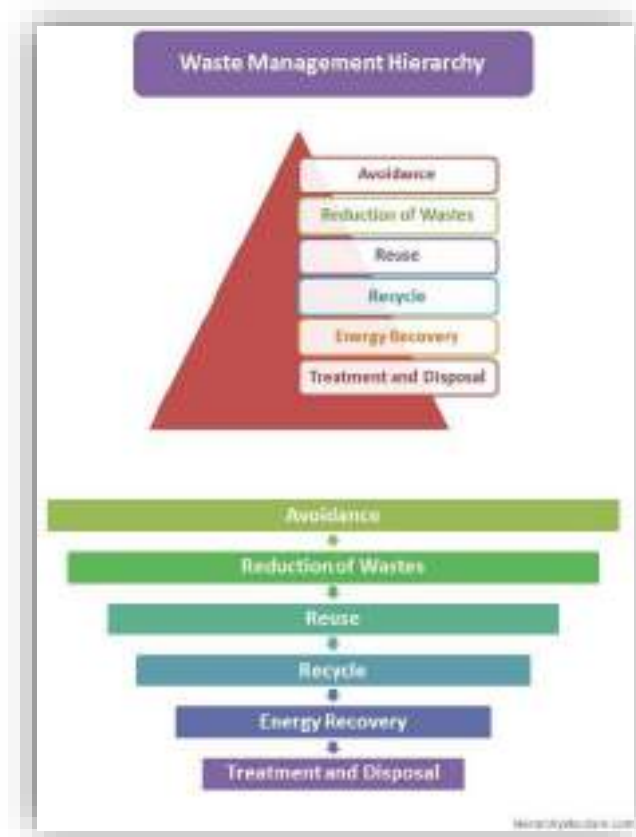


Figure 18-3 Waste Hierarchy

The typical anticipated waste defined by its physical, biological and chemical characteristics are categorized into the following generic waste types:

- Municipal Waste;
- Non-Hazardous Industrial Waste (including construction waste); and
- Hazardous Waste.

Overall, the Construction Contractors will ensure that all wastes will be handled as per local and national Environmental Standards. It is essential to identify all types of wastes that will be generated during construction and plan in advance to ensure proper disposal or treatment of each wastes. Wastes must be transported only using licensed service providers authorized to handle the type of wastes and must be disposed only at licensed facilities. All waste transfers must have auditable waste disposal/transfer notes. No waste must be treated or disposed at the AR-SIPVPP site or any other unauthorized locations and that includes burial or burning.

The mitigation measures that must be implemented for adequate management of wastes are provided in this report.



18.9.5.15 Traffic and Transport

The Traffic Management Plan must include mitigation measures to minimize the impacts of construction activities on local traffic, measures to avoid traffic movement through populated residential communities, measures to minimize traffic disturbances and associated impacts from noise, on terrestrial ecology, speed limitations in respective areas and where required, and public notification of any anticipated traffic-related concerns, such as road closings. It must also clearly show the identify access roads for construction vehicles and safety measures used for pedestrian and other road users.

18.9.5.16 Heritage and Archaeology

Following consultation with SCTH, it is agreed that a full programme of mitigation will be developed with SCTH. This will initially consist of a survey of areas of archaeological potential by SCTH, who will then record sites as required. This might include, but not be limited to, survey, recording, and excavation, with all results published. SCTH will declare the areas cleared for development once their works are completed.

18.9.5.17 Environmental Monitoring and Self Assurance Auditing

This section of the Construction Contractors' CESMP must include information regarding the compliance and effects monitoring and self-assurance auditing of environmental performance and include the environmental checklists and procedures that will be followed. It must discuss how applicable environmental and social aspects will be monitored, the methods to be used and the parameters that will be measured, sampling or monitoring locations, frequency of measurements, detection limits, the thresholds that trigger corrective actions, and the party who will conduct monitoring.

This section must also include procedures that indicate corrective actions for non-compliance with monitoring targets, specifying notification requirements to responsible personnel and the time frames for notification and for corrective actions to be performed.

18.9.6 Incident and Emergency Management

The contractors CESMP(s) will provide a comprehensive general emergency procedure for all foreseeable eventualities that pose significant risks to site personnel, local communities and the environment which must be implemented and adequately communicated to all involved parties during the construction phase of the Project.

The procedures will include provisions for the following:

- Chemical/fuel spillage;
- Chemical/oil spillage emergency plan;



- Responsibilities, including managers, incident controller, firefighting party, search party and rescue team/first aid team;
- Evacuation procedures;
- Communication and alarm procedures;
- Assembly points;
- Incident reporting;
- Training and rehearsals (mock drills); and
- Emergency instruction notice for workers.

The emergency response plans must be supported by planned simulated training exercises in order to test their robustness and practicability.

The Contractor must give immediate notification of any environmental incident. Initial notification may be verbal but shall in any event be followed by a preliminary written report within 24 hours of the incident. A detailed written report must be submitted within seven days. The Contractor is required to also report all incidents to relevant authorities.

The following initial procedures will be adopted where possible while using hazardous materials during construction:

- Elimination: Removal of a hazardous substance that is not essential;
- Substitution: Using a less hazardous substance;
- Isolation: Separation of a process from employees by distance or by barriers; and
- Controls: Using machinery, equipment or processes that minimize workplace contamination by containing or removing hazardous substances.

Proactive steps to prevent spill will be taken, such as placing at risk containers in bunds and equipment on drip trays. Spill control measures involve the placement of spill kits at risk locations around the construction site. The spill kit must have appropriate signage indicating its normal location when not in use, and instructions for usage within the kit. The spill kit must be suitable for the size and type of chemical being stored.

Training of employees including the understanding of Material Safety Data Sheets (MSDS) and spill response must also be undertaken. The Contractor must also ensure a fit-for-purpose spill kit is available to cater for the quantity of Regulated wastes onsite. Ensure a fit-for-purpose spill kit is available to cater for the quantity of Regulated wastes onsite. The spill kit must contain the following as a minimum.

- PPE;
- Absorbent mats;



- Spill boom; and
- Sandbags, if the amount of liquid on site is greater than the quantity of the above three items can reasonably cater for.

18.9.7 Reporting

This section of the Construction Contractors' CESMP must show the proposed reporting programme, detailed in section 18.5.2 that the contractor will follow throughout the Project construction. It must clearly state the frequency and timing of reporting environmental performance status and must include the following:

- Daily Report;
- Weekly Report; and
- Monthly Report.

Finally, the CESMP must report and record details about: (1) stakeholder engagement and complaint management (as required); and (2) what information will be available for contractors and visitors on site.



SECTION 19 SUMMARY OF IMPACTS, CONCLUSION AND RECOMMENDATIONS –ESIA OF AR RASS SOLAR, POWER PLANT PROJECT



SECTION 19 SUMMARY OF IMPACTS, CONCLUSION AND RECOMMENDATIONS –ESIA OF AR RASS SOLAR, POWER PLANT PROJECT

Ar Rass Solar Independent PV Power Plant (AR-SIPVPP), Ar Rass -ESIA has systematically reviewed the potential effects of the Project on the existing environmental, social and ecological sensitive receptors as part of the AR-SIPVPP assessment of project activities.

AR-SIPVPP construction works constitutes the critical phase in terms of physical footprint impacts. Given the constraints in available detailed design at the time of writing it is recommended that any deviation or variation in the presented spatial extent of the AR-SIPVPP construction works is considered environmentally prior to construction commencement. The assessment was undertaken in accordance with the national policies, laws, regulations, standards and guidelines, as well as international conventions (to which the KSA as a sovereign state is a signatory) that apply to the environmental and social aspects of the Project. The assessment is also guided by IFC principles and guidelines.

It should be noted, that all stakeholder engagement that has occurred to date in this ESIA process between M/S ACWA Power Company (Saudi Listed Joint Stock Company), EBC and respective stakeholder groups though cultural and political limitations and the lack of any enabling legislation. While such limitations are respected by the Project, they create few gaps with the expectations of PS1 and PS7. Such gaps are being pursued as far as possible by M/S ACWA Power Company (Saudi Listed Joint Stock Company), and fed back to the design programme.

Potential short term and long term, direct and indirect as well as cumulative impacts were identified using standard assessment methodology and subsequently additional mitigation measures and enhancement controls were identified to try and help ensure that any negative impacts are minimized and reduced. For any beneficial impacts identified, ways to further enhance and improve them were also explored. The majority of potential negative impacts for the ACWA Power Company (Saudi Listed Joint Stock Company), construction works has been mitigated with the significance of the residual impacts being identified as being Low / Minor or Negligible due to the temporary and short-term nature of the impacts. However, key concerns were raised regarding the loss of potential natural habitats and disturbance to sensitive fauna.

Although the AR-SIPVPP construction works areas are out with of the direct footprint for fauna, indirect impacts may occur, therefore, measures considering noise, vibration, light and general



disturbance in the vicinity of these buffers as well as with excavations across the sites where lizards may burrow will be required to ensure the protection of these receptors.

Areas defined as Critical or Natural Habitat should be avoided as far as possible. The Critical Habitat Screening Assessment outlined potential risk areas and required offset strategies and mitigation considerations for the Project.

It is anticipated that the development will not significantly increase risks of sedimentation into the environment with appropriate construction management measures in place. Further to these specific measures, mitigation measures to minimize impacts and ensure that impacts achieve the residual impacts stated are proposed throughout this report and summarized in the CESMP. Monitoring will be required to help ensure that the implemented mitigation measures are effective. Ongoing consultation will be critical with the SCTH prior to works being undertaken to agree on the required mitigation measures and action to be undertaken and by whom. This is of particular importance if the areas identified as archaeologically significant. This phase of the project will also bring beneficial socio-economic impacts, including thousands of direct and indirect jobs to the local, national and regional economies.

- AR-SIPVPP have no associated facilities in the proposed project. Construction of Ar Rass Solar Plant and for which trenching, excavation, piling are the major components of the project. There will be site offices, Vehicle parking, Storage yard, and associated facilities; none of the facilities will be affected by the proposed AR-SIPVPP. Therefore, no mitigation is required.
- AR-SIPVPP area is developed area for Solar Power Plant near to Ar Rass. There are no indigenous communities existed within or in the vicinity of AR-SIPVPP area. There is no displacement of population. Similarly, there is no endangered and ecologically important natural vegetation is found in the project area. The CESMP and ERA recommendations are required to be implemented to conserve the existing Terrestrial habitat. Further M/S ACWA Power /EPC Contractor requires to undertake a mandatory requirement of NCEC/ NCWM as this is the normal procedure of NCEC/NCWM/NCW, KSA.

Overall, the Project needs to be viewed as a whole as well as in light of the cumulative impacts of other regional developments. This will develop as future phases of the Project mature and information becomes available to assess.



The Present Environmental and Social Impact Assessment Study has been carried out to comply with requirements for an ESIA, as mandated by the NCEC and to comply with Equator Principles 2020 (IFC Standards PS1~PS 8). Hence the main objective of this ESIA is to assess in advance the impacts from the AR-SIPVPP Project and to identify mitigation and control measures to be included while planning the project.

The ESIA study has been prepared following the guidelines prescribed in Appendix 2.4 of GER /NCEC /EP 2020 procedures for project environmental assessments. (Issued in July 2020) Further, this ESIA has been carried out in fulfillment of the M/S ACWA Power 's commitment to environmental protection as stated in their respective policies and standards. The study involved comprehensive review of literature, field surveys, Water Quality, assessment of Air Quality, Noise measurements, Socio economic studies, impact assessment and reporting. The main conclusions from the study are presented below.

Following tasks were undertaken

- 1. Desktop study for screening and Scoping**
- 2. Establishment of Environmental Baseline**
 - Air Quality and Meteorological Monitoring
 - Noise Monitoring
 - Terrestrial Ecological Surveys
 - o Flora
 - o Fauna
 - Soils and Geology
 - Socio Economic Study
 - Archaeological studies
 - Resource consumption and efficiency etc.

3. Impact identification

4. Identification of mitigation measures

5. Preparation of ESIA report

Following are the conclusions of the ESIA study

Construction Phase Impacts

The potential impacts from the construction activities include the following:



1. Dust will be generated from the activities such as site clearing, grading, levelling, removal of excess of soil/sand and stockpiling will result in the generation of dust. A temporary surge in ambient dust levels is expected for the construction period. Other stressors on ambient air include exhaust emissions from construction equipment and excavators.
2. AR-SIPVPP will cause following impacts on soil and geology of the area:
 - a. Piling, foundation, stockpiling of excavated material for foundation, earth filling and other earthworks
 - b. High levels of noise
 - c. Soil erosion
3. Compaction of soils in undisturbed areas
4. Changes to the natural drainage from excavation, grading, levelling, excavation and other activities
5. Potential for soil contamination from any accidental spills of fuel oil and/or chemical spills, and other spills
6. The natural topography in the project area will be temporarily altered by the excavation and stockpiling that would be affect air quality. Typically, the environmental concerns from undertaking these activities include the potential deposition of dust in the adjoining and the potential for erosion due to the effects on circulation.
7. A large volume of water will be required to provide the personnel in the construction phase during the construction period. Additionally, potable water will also be required to meet watering, mixing and other needs from the construction activities. Potable water will be sourced from the national supply network operated by SWCC.
8. Sanitary wastewater is expected to be generated from the resident work force. From discussions with the project team it is understood that NCEC licensed Waste water dealer will receive all wastewater from the workers camp. However, no information is currently available on the treatment scheme. It is expected that wastewater will be treated to comply with NCWM /NCEC's Irrigation standards for reuse at the site in construction activities (e.g. dust suppression).
9. The site is vegetated with sparse floral species that are not of conservation value. The area however does support faunal movement.



10. As construction activities will involve excavation, piling foundation, site preparation activities such as clearing, grading, levelling, excavations, cut and fill, and piling a surge in noise levels will inevitably occur in this phase.
11. Noise surveys were done by spot measurements during baseline surveys. However, given the isolated nature of the site background noise levels are likely to be consistent at any time of the day or night as there are no major activities within or at the perimeter of the project site. From the results it could be observed that the major noise around the project area is from the vehicles traversing the site, wind from the sea while further inland is a low noise area.
12. AR-SIPVPP project is not expected to cause any adverse impacts on local communities in the region taking into consideration the following:
 - Given that the proposed project is located within the AR-SIPVPP premises, no forceful land acquisition or involuntary resettlement would be required.
 - It is likely that small businesses such as contracting companies, manpower supply firms, trading establishments, fabrication yards and other similar businesses will benefit from local procurement requirements for the construction effort
 - The project in full operation is expected to employ Saudis and expatriates in various positions for the operations phase activities. The project is expected to contribute to stimulating the local, regional and National economy once **AR-SIPVPP starts operation which will reduce the stress of power generation by fossil fuel and reduce carbon emissions in turn enhance the revenue and environmental protection.**

Operational Phase

AR-SIPVPP will not result in any negative impacts during operation. The project will complete in 20 months and most of the impacts are temporary in nature. During operation a new habitat for avifauna will be created. Further greenery will be developed creates new habitat for flora and fauna.

Recommendations

- 1) Deployment of Dust control techniques during excavation
- 2) Safe management of stockpiled material to avoid dust
- 3) Proper dewatering practices
- 4) Safe disposal of surplus soil material at the approved location
- 5) Care should be taken to reduce the noise levels from equipment
- 6) Habitat management



- 7) Safe disposal of demolished material to NCEC approved land fill
- 8) Air pollution management from the construction equipment
- 9) Good housekeeping of site and accommodation of workers
- 10) Habitat management
- 11) Documentation of environmental records
- 12) Daily Environmental monitoring
- 13) Installation of continuous water quality monitoring station at intake and outfall
- 14) Periodical Environmental Audit and obtain approval from NCEC
- 15) Environmental Training and awareness to the staff
- 16) Proper Waste management and safe disposal through NCWM/NCEC Approved Contractor
- 17) Implementation of required programme as agreed with NCWM /NCEC

Limitations

This ESIA study concludes that the AR-SIPVPP project will contribute to the development of the central / NE region as existing infrastructure is not reaching the demand. While the impacts are largely localized, the implementation of mitigation measures in the sections 7~17 of this report will ensure they are substantially mitigated.

Flood Risks:

The history of flood events reveals that there were no flood events in the proposed AR-SIPVPP. However, ACWA POWER / the EPC contractor has to prepare a Flood Risk Assessment Study /Storm Water Management plan before the construction works and implement it during Construction and Operation.

Resettlement: The project is located in an isolated area which was unused and now using for AR-SIPVPP where there are no communities existed. There is no requirement of resettlement.



APPENDIX-A: SOCIO ECONOMIC STUDY QUESTIONNAIRE AND SURVEY SUMMARY, FORMAT USED FOR SURVEYS



APPENDIX-A: SOCIO ECONOMIC STUDY QUESTIONNAIRE AND SURVEY SUMMARY FORMAT USED FOR SURVEYS

SOCIO ECONOMIC SURVEY QUESTIONNAIRE USED FOR ESIA OF AR -RASS SOLAR INDEPENDENT PV POWER PLANT (AR-SIPVPP), AR-RASS

In general terms, how much do you agree with the following?

Regarding health, home and local community...	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
I have concerns of how the project will affect my family	☐	☐	☐	☐	☐
I am worried the project could affect local health care services	☐	☐	☐	☐	☐
I am worried about unforeseen health risks	☐	☐	☐	☐	☐
Less pollution will make us all healthier	☐	☐	☐	☐	☐
I am happy future generations will have cleaner air	☐	☐	☐	☐	☐
I believe AR-SIPVPP proposes a health risk	☐	☐	☐	☐	☐
There are high levels of stress in my home often	☐	☐	☐	☐	☐
Money is a big source of stress for me	☐	☐	☐	☐	☐
I wish I had better job skills, more training	☐	☐	☐	☐	☐
I wish I had a more secure job	☐	☐	☐	☐	☐
I wish I had more education	☐	☐	☐	☐	☐
My Opinion about the project benefits	☐	☐	☐	☐	☐
My opinion about changes in the life style	☐	☐	☐	☐	☐

I have concerns that the following periods would lead to a trend in

Regarding health, home and local community...	5 Year Period During Construction	5 Year Period After Construction	50 Year Period After Construction
Health care service response times	☐	☐	☐
Unforeseen health risks	☐	☐	☐
Air pollution	☐	☐	☐
Water pollution	☐	☐	☐
Overall levels of stress in my home	☐	☐	☐
General cost of living	☐	☐	☐
Personal financial difficulties	☐	☐	☐
Availability of job training	☐	☐	☐
Job security	☐	☐	☐
Affordable education	☐	☐	☐
Vehicle traffic near my home	☐	☐	☐
Local noise levels	☐	☐	☐
Increased traffic	☐	☐	☐
Available affordable housing	☐	☐	☐



Do you believe the AR-SIPVPP development project have an impact on your family life?

(Circle your answer)

Yes / No

Please describe how and why you feel this way:

Considering your surrounding community, describe your concerns, fears or comments about the impact of the AS-SIPVPP development project?

Please describe the effects that you think AR-SIPVPP bring the possible benefits to the community.

Employment opportunities...

Do you feel that your job or current skills would provide you with a job directly or indirectly related to the AR-SIPVPP development project? **Yes/No**

If no, what skills or job training would you need to help find related employment?

A) Are you in a position of hiring/firing employees and/or maintaining a staff from human resources AR-SIPVPP? (Please circle)

Yes/No

B) If Yes, do you feel the construction period of this AR-SIPVPP will have a positive or negative affect on your available resources (Please circle)

Positive/Negative

How much do you agree with the following statements?

Regarding employment...	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
AR-SIPVPP will create new short-term jobs	☐	☐	☐	☐	☐
AR-SIPVPP will project will create new long-term jobs	☐	☐	☐	☐	☐
I am concerned about short term affects to my job security	☐	☐	☐	☐	☐
I am concerned about long term affects to my job security	☐	☐	☐	☐	☐
Hiring priority should be given to local Residents	☐	☐	☐	☐	☐
Specialized job training should be given to local Residents	☐	☐	☐	☐	☐
Out of region hiring influx will hurt local hiring	☐	☐	☐	☐	☐
I am concerned that new jobs created as a result of development will displace or harm existing	☐	☐	☐	☐	☐



jobs					
When development is complete it will cause a downward trend in the local employment	☒	☒	☒	☒	☒
Proper planning now could prevent a downward unemployment trend later	☒	☒	☒	☒	☒
I believe that the positive overall employment impact outweighs any negative impacts that may occur	☒	☒	☒	☒	☒

Please describe any particular feelings, concerns or fears you have with regards to employment that relate to the AR-SIPVPP project?

Land use and the environment

Please select your level of concern about the following:

Possible environmental impacts such as	Not Concerned	Somewhat Concerned	Extremely Concerned
Air quality	☒	☒	☒
Climate change, including the effects of climate change interacting cumulatively with the predicted environmental effects of the project and the project's contribution to climate change;	☒	☒	☒
Biological diversity	☒	☒	☒
The cumulative environmental effects of existing and new development	☒	☒	☒
Disturbance to unique sites or special features (e.g., protected areas; Environmentally Significant Areas, etc.);	☒	☒	☒

General Information

1) Settlements

a) How long have you lived in this area

- () Less than 20 years
() Over 20 years
() Less than 10 years

b) Give reasons why you moved into this area

- () Native of the area
() Other (specify)

c) How do you characterize your homestead?

- () Permanent
() Temporary

2) Sources of income



a) How do you classify yourself?

- ☐ Employed
- ☐ Never employed
- ☐ Businessman
- ☐ Retired/retrrenched

b) What are your main sources of income?

- ☐ Salary
- ☐ Business
- ☐ Trading

3) Water resources

a) Indicate sources of drinking water

- ☐ Well
- ☐ Desalinization Plant
- ☐ Municipal Supply
- ☐ Other (specify)

4) Area Problems

What do you think are the main problems in your area:

- Lack of health facilities
- Floods
- Lack of schools
- Too many people
- Traffic
- Pollution
- Other (specify)

5) Area Management Issues

a) Are you satisfied with the current government policies on:

- ☐ Pollution
- ☐ Water
- ☐ Waste Management
- ☐ Traffic

b) Are you aware of the functions of these Organizations /Institutions:

- Fisheries Department
- Municipality
- Health Department
- NCEC
- Royal Commission of Jubail
- Department of Agriculture

ECOLOGICAL SURVEY

1) Fisheries issues

a) Are you engaged in fishing?

- ☐ Yes
- ☐ No

b) If you are, do you do it for

- ☐ Commercial reasons
- ☐ Subsistence reasons

c) What are the common fishing methods used

- Nets
- Baskets



- Fishing traps

3) Wildlife Resources

a) Do you hunt wild animals?

☐ Yes

☐ No

b) What are the common hunting methods in your area:

- If you hunt, for what reasons do you do it? Guns

- Snaring

- Other (specify)

f) Do you think wildlife is declining in your area?

☐ Yes

☐ No

☐ Not sure

g) Give reasons if there is a decline

- Too much hunting

- Too many people

- No protection

- Don't know

- Poor policy

- Weak legislation

h) What do you think should be done?

- Hunting birds should be stopped

- Hunting animals should be stopped

- Don't care

i) Do you think conservation of wildlife in the area:

☐ Is adequate

☐ Should be increased

☐ Should not change

☐ Don't know

Final thoughts...

Considering everything you've now heard, read, and answered, do you feel that you prefer AR-SIPVPP development would enhance, life style and we are happy the project to proceed.

Please tell us which site and why you feel that way.

If you could name the one thing you would hope to gain from the AR-SIPVPP project, what would it be?

If you have any final question, comments or concerns about what you've heard, seen or read related to the AR-SIPVPP developments of any of the locations, please write them below.

Thank you for making the time, one last thing...



We thank you for taking the time and giving us your thoughts on the AR-SIPVPP development project. The answers and comments you provide will allow Ministry of Energy to better address local concerns and take steps to work with communities, local organizations, local government and land claim beneficiaries to make sure that we proceed in a safe and respectful way.

In what capacity would you liked to be involved with in the future?

How should we contact you in the future?

☐ By regular mail

☐ By phone

☐ By email

Name: _____

Name: _____

Address: _____

Phone: _____ Email: _____

For more information please visit www.ehc.com.sa, info@ehc.com.sa, info@environmentalbalance.co,
suresh@ehc.com.sa

Once again, we thank you for your time.



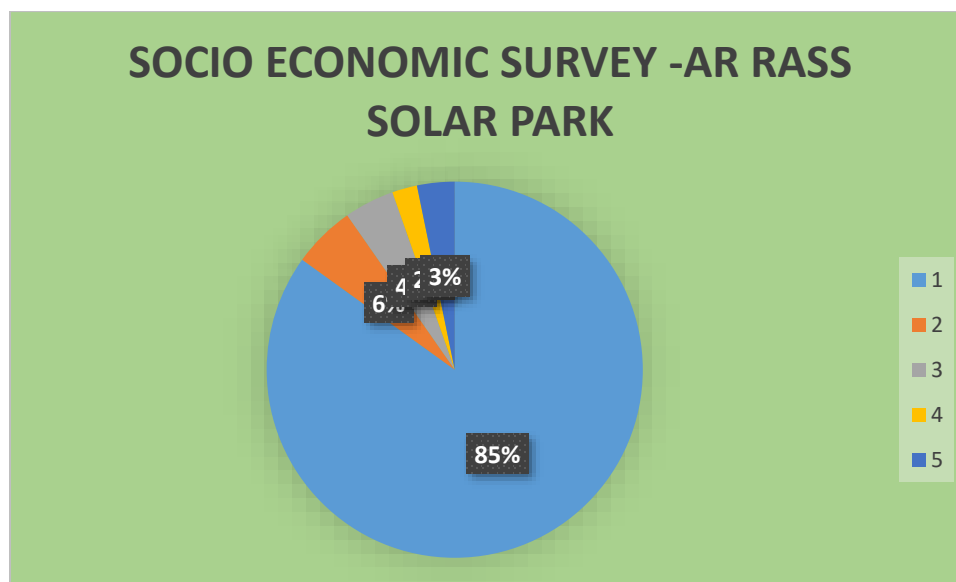
SUMMARY FOR SOCIO-ECONOMIC SURVEYS FOR AR RASS SOLAR INDEPENDENT PV POWER PLANT (AR-SIPVPP), PROJECT

Name	Nationality	Educational Attainment	Workplace	Position	Opinion and Interest to Project
1. Abdul-Rahman	Indian	Higher Secondary	Restaurant	Tea Boy	1
2. Mustafa Ahmed	Saudi	High School	Work shop	Mechanic	1
3. Zaheer Abbas	Pakistan	Engineering	Company	Engineer	1
4. Mazen Othmen	Palestinian	Engineering	Company	Engineer	1
5. Atif Suleman	Saudi	University	Company	Labour	1
6. Akram Zuhair	Saudi	University	Shop	Shop Keeper	1
7. Sajid Nazeer	Saudi	University	Mall	Sales man	3
8. Khaleel Salem	Egyptian	High School	Petrol Station	Petrol station	1
9. Ahmed Al Ghamdy	Saudi	Engineering	Company	Manager	1
10. Khashif Baig	Egyptian		Work Shop	Technician	1
11. Mansoor Ali	Saudi	University	Stores	Supervisor	1
12. Murad Shoaib	Egyptian	Engineering	Company	Manager	2
13. Waseem Akram	Saudi	Engineering	Company	Engineer	1
14. Suhail Abdullah	Saudi	High School	Mall	Sales man	1
15. Aban Ali	Egyptian	High School	Garage	Mechanic	2
16. Mohammed Najeeb	Saudi	High School	Mall	Shop Keeper	1
17. Hammad Farooq	Saudi	High School	Mall	Security	1
18. Sakheeb Aslam	Saudi	University	Government	Police	1
19. Abdulah Othaibi	Saudi	Engineering		Engineer	1
20. Mujeeb Ur Rehman	Egyptian	Para medical	Hospital	Lab Technician	1
21. Zaheer Haseeb	Saudi	Medical Degree	Hospital	Doctor	2
22. Iqbal Basha	Egyptian	University	Company	Officer	2
23. Mohmed Sabeer	Saudi	University	Shop	Accountant	1
24. Mohammed Saggaf	Saudi	University	Government	Officer	1
25. Anwar Khan	Saudi	University	High School	Teacher	1
26. Mohammed ali	Egyptian	High School	Fisheries shop	Fisherman	3
27. Irfan Patan	Saudi	University		Teacher	1
28. Mohammed Asauddin	Saudi	University	Company	Engineer	1
29. Firoz Khan	Indian	University	Shop Owner	Shop keeper	1
30. Junaid Abdullah	Saudi	University	School	Teacher	1



Legend:

- (1) Very Positive
- (2) Generally Positive
- (3) Neutral
- (4) Generally Negative
- (5) Very Negative





APPENDIX-B STAKEHOLDER CONSULTATION

SI No	Departments	Purpose	Date
1	Ministry of Environment Water and Agriculture (MEWA)	To discuss the details of the Project and follow-up PCA/ESR for Ar Rass Project,	01.03.2023
2	Ministry of Transport	To discuss the details of the Project and gather the information on Traffic of Ar Rass area	15.13.2023
3	Municipality of Hail & Qasim	To discuss the details of the Project and follow-up preliminary and final approval for Ar Rass Project,	05.04.2023
4	NCWCD/National Center for Wild life	➤ To discuss the details of the Project and gathering the data on wild life of Ar Rass Area,	10.04.2023
5	NCEC	➤ To discuss the details of the Project and gathering the data on Meteorology and Terrestrial / Environment of Ar Rass Area, ➤ Follow up Project Classification ➤ Follow up approval of Environmental Scoping Study ➤ Follow up EIA Approval	Several
6	Saudi Geological Survey	To discuss the details of the Project and gathering the data on Soils and Geology of Ar Rass Area	10.04.2023
7	Ministry of Interior	To discuss the details of the Project and obtain Survey Permits	Several
8	Saudi Commission for Tourism and National Heritage (SCTH)	To discuss the details of the Project and follow-up preliminary and final approval for Ar Rass Project,	11.05.2023



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