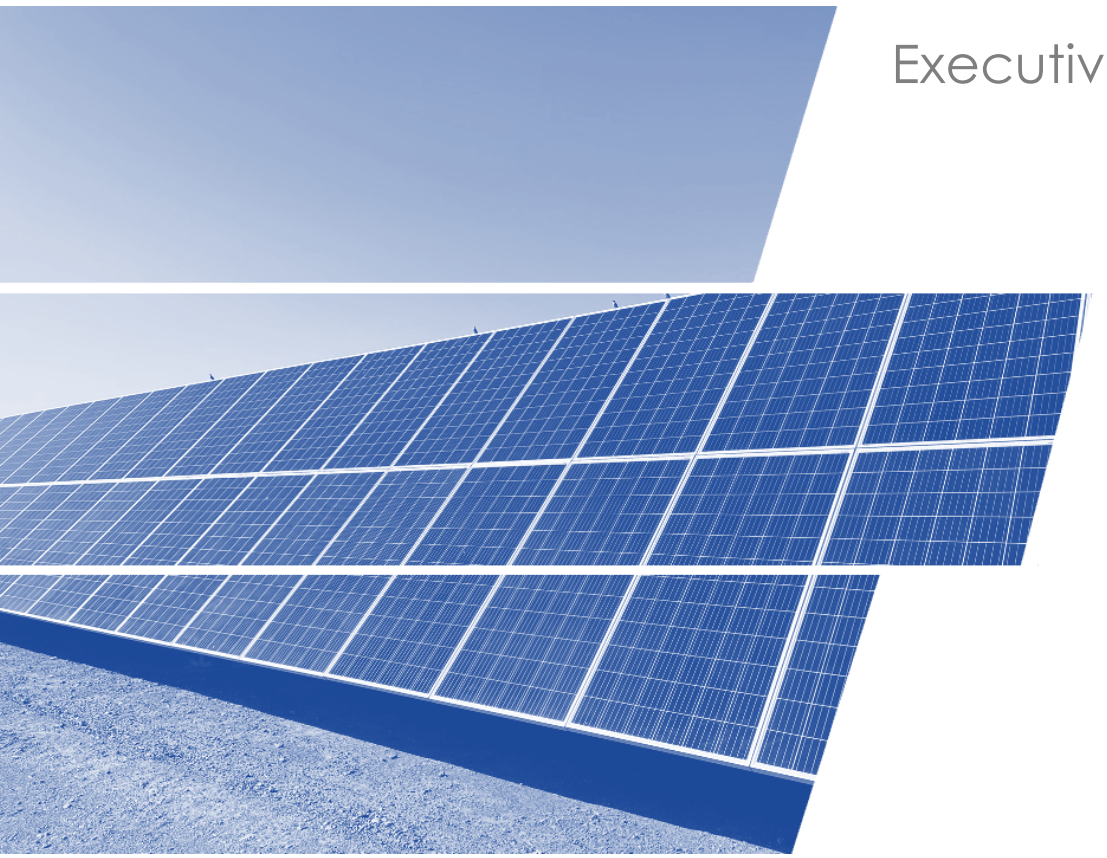
Ajban Solar PV Plant Independent Power Project

Abu Dhabi, UAE

Environmental and Social Impact Assessment – Executive Summary



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1 PROJECT DESCRIPTION

The proposed project is the Ajban Solar PV Independent Power Project (hereafter referred to as 'the Project') initiated by the Emirates Water and Electricity Company (EWEC) which will be developed at the Ajban area of the Emirate of Abu Dhabi as indicated in following figure. The Project also includes the development of a 400 kV substation towards the north-western corner of the Project site comprising four High Voltage (HV) transformers. Once operational, the Project will have a net power generation capacity of 1.5 Giga Watts (AC) of electricity.

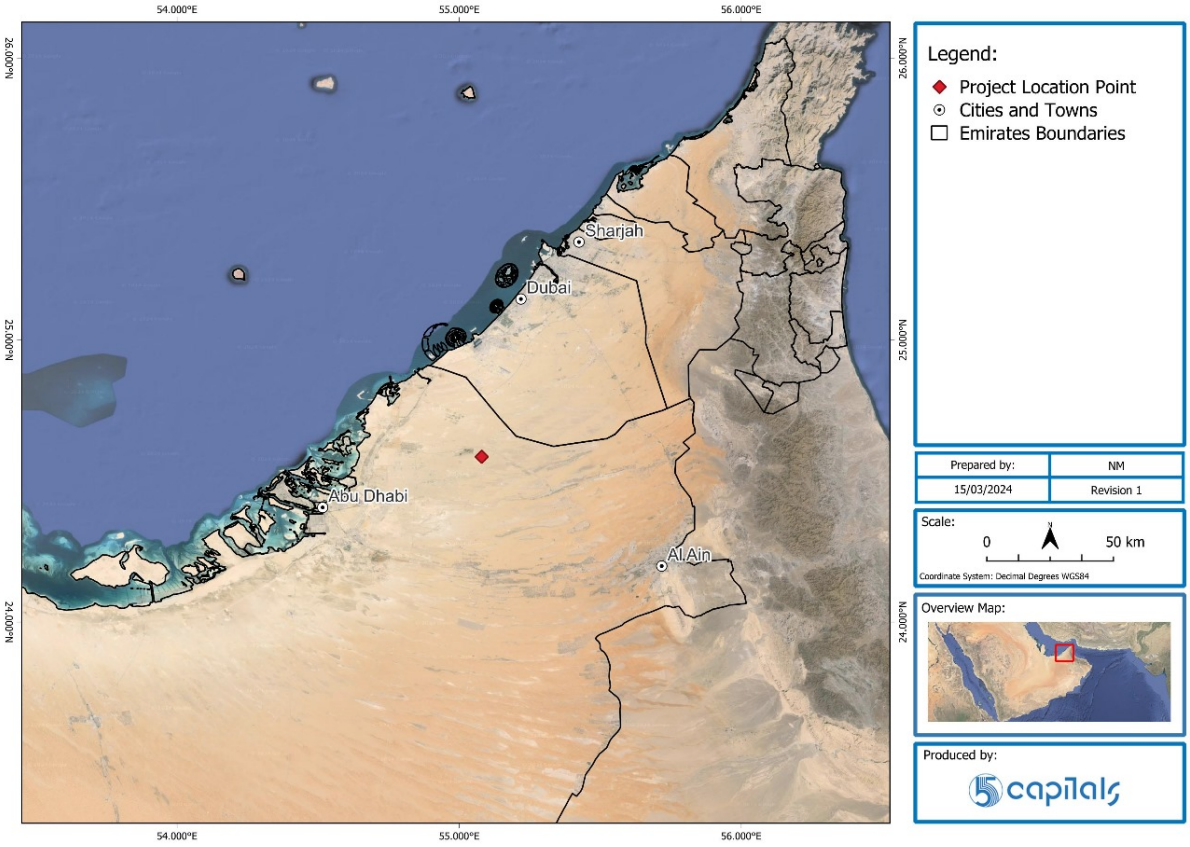

Figure 1-1 Project Location

EWEC, who is the sole procurer of power and water within the Emirate of Abu Dhabi has identified the need for additional renewable energy projects to increase the power generation capacity of the Emirate to meet the anticipated increase in demand. The greenfield solar PV Independent Power Plant (IPP) is fundamentally important to the energy transition and sustainability strategy of Abu Dhabi and will play a pivotal role in successfully achieving the sustainability and energy diversification objectives of UAE Energy Strategy 2050, and the UAE Net Zero by 2050 strategic initiative through the use of renewable and clean energy. The Project will generate enough electricity for approximately 160,000 homes across the UAE and, once commercially operational, it is expected to reduce Abu Dhabi's CO_2 emissions by more than 2.4 million metric tons per year.

EWEC has appointed a consortium formed by EDF Renouvelables SA (EDFR) and Korea Western Power Company (KOWEPO), both experienced international companies to develop the Project. Both EDFR and KOWEPO focuses on developing, building and operating large scale renewable energy projects such as wind, solar and energy storage projects, with approximate installed capacities of 10.7 GW and 14 GW respectively globally.

In accordance with the environmental permitting requirements of the Environment Agency Abu Dhabi (EAD), a Terms of Reference (ToR) was prepared by Green Consulting company which was approved with conditions by EAD in September 2022.

1.1 Site Conditions and Land Use

The Project site is located in an isolated undulated desert area of Abu Dhabi with few other land uses and activities, primarily related to camel farms taking place in the surrounding area. The Proposed Project is located approximately 25 km from the small town of Sweihan and about 80 km northeast of Abu Dhabi city and covers an area of approximately 20 km^2 (2,000 Ha) which is situated within the eastern corner of a larger area known as the Zayed Military City. Considerable parts of the site are covered with sand dunes, mainly within the southern portion of the site.

The land uses and activities in the surrounding area were identified during the primary and secondary data collection phases undertaken for the ESIA. Majority of the Project site can be classified as sand sheets with sparse vegetation. Several human and ecological features within and around the Project boundary have been identified. The Ajban Palace is located very close to the Project site, to the west.

1.2 Key Design Features of the Project

1.2.1 PV Components

The project will comprise 1.5 GW (in AC power and 1.8 GW in DC power) PV Plant using bi-facial technology. The PV cells within modules will be mounted on single axis tracker arranged to ensure the most efficient alignment for the capture of solar radiation.

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

1.2.2 Electrical Substation Facilities

The Substation will be located at the north-western corner of the Project site as outlined earlier in this report covering an area of approximately 13 Hectares (Ha). This facility will consist of electrical equipment and buildings for housing the electrical equipment. The project substation will comprise (3+1) HV transformers.

1.2.3 Roads

The access to the Plant will be from the road E75 located to the east of the Project site. Additionally, there will be an access from the public road to the substation. These will be asphalt roads of width 6 meters.

Internal periphery roads within the Project site will be developed such that it is adequate and suitable to connect to the road network to facilitate transportation of equipment to and within the site. These roads are compacted gravel roads which are 4 meters wide. Between the rows of PV modules, these will be compacted tracks and not paved.

1.2.4 Utilities – Wastewater

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

Panel cleaning will not generate any wastewater due to the use of dry automated robotic cleaning technology, which is also the case for other PV projects in Abu Dhabi, namely PV1 and PV2. It is possible that on occasions water may be used in certain areas for cleaning, however, under normal operations, this is not expected.

1.2.5 Utilities – Electricity Supply

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

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

1.2.6 Stormwater Drainage

Based on the hydrological and flooding study conducted for the Project site, the values of flow velocity associated to previous depths are almost null for all the small, flooded areas. Therefore, for the current terrain, no drainage systems are considered. However, after the

grading of sand dunes Hydrology study shall be done and this consideration shall be reconfirmed.

1.2.7 Instrumentation and Control System

A consistent instrumentation and control (I&C) philosophy will apply throughout the Ajban Solar PV Plant and will be implemented in terms of a range of equipment exhibiting a minimum diversity of type and manufacture. The objective be to standardize all measurement and control equipment throughout the Ajban Solar PV Plant to rationalise operation and maintenance and reduce spare parts holding.

1.2.8 Meteorological Station

A total of sixteen (16) meteorological stations are considered to be installed at representative locations throughout the PV Plant area. The meteorological stations will be designed and equipped according to Class A of IEC 61724-1. This includes data acquisition and timing, measured parameters, data processing and quality check.

1.2.9 SCADA System

The SCADA system utilised for the Project will be a proven and fully functional system, suitable for performing the operation, maintenance and monitoring functions associated with the Solar Farm and the Grid network.

The monitoring facilities are based on an online instrumentation and data acquisition and logging system and data transferred directly to the Plant distributed control and data acquisition system. The system will incorporate access rights to ensure data integrity.

The System will be able to be switched to one of the following functionality modes (Automatic, Manual, Local & remote).

1.2.10 Auxiliary Power Distribution Line

The Project will require a 33 kV underground line to the nearest available Abu Dhabi Distribution Company (ADDC) Substation for backup electrical support. It is to ensure that the Plant components have a reliable source of electricity to function properly, support plant operations, and facilitate monitoring, control, and communication functions. Even though this line is part of the Project, currently, the route of this line is undetermined, and, likely to span several kilometres of underground cable.

Even though the route is not confirmed at this stage, it is likely to follow an existing utility corridor to avoid any significant impact or disruption to existing infrastructure and land uses. However, this cannot be confirmed at this stage due to lack of sufficient information currently.

1.3 Main Project Construction Activities

Power China Huadong Engineering Corporation and Power Construction Corporation of China will be the Engineering, Procurement and Construction (EPC) contractor for the Project. It is estimated that approximately 5,000 construction workers will be required during peak construction stage who will be accommodated within existing workers' residential facilities without having the need to build any new workers' camp/s for the Project. The EPC contractor will be responsible for construction works. The principal construction activities for this project are related to infrastructure and civil works and mechanical and electrical works.

The scope of works of the EPC contractor include site investigation and assessment, detailed engineering and design, selection of materials, preparatory works, all Project related civil works, mechanical works, electrical systems, communication systems, procurement, installation, commissioning, start-up, testing, training and completion of the PV Plant .

The key Project construction activities concerning infrastructure and civil works include:

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

Initial construction works will entail movement of approximately 5 million m^3 of surface soil/sand. As the site is located in a desert area, the excavated material consists mainly of fine sand and mostly will be used as backfilled material at site. The project design will follow the principle of 'balance of cut and fill', aiming to avoid export of the excavated soil or bringing in material from offsite location. If unavoidable, surplus material will be transported to a location specified by the municipality. All tracker piles will be installed by direct ramming.

According to the EPC Contractor, the preliminary planned main temporary office area and workshops will be located near the site substation. Although unconfirmed at this stage,

laydown areas will likely be provided for each sub-contractor engaged at the Project. Such areas are expected to include the following temporary facilities:

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

2 SUMMARY OF FINDINGS

A summary of the main findings from the impact assessment including, potential impacts, their assessed significance as well as proposed mitigation and monitoring measures are presented in the following tables for both construction and operational phases.

Table 2-1 Impacts, Mitigations and Monitoring Summary – Construction Stage

PROJECT ASPECT (SOURCE OF THE IMPACT)	ENVIRONMENTAL IMPACT	IMPACT SIGNIFICANCE	SELECTED MITIGATION MEASURES	MONITORING PROGRAM DESCRIPTION	RESPONSIBLE PARTY FOR MONITORING
Air Quality					
Site preparation and earthworks	Increased suspended particles in air and dust deposition	Minor	• Defined haul routes to be used at all times by site vehicles. • Prompt mitigation of visible dust emissions, by measures such as stabilisation of surface silt content through application of water sprays. • Provide impervious covers to stockpiles of all materials that might generate airborne PM. • Limit the height and slope of stockpiles and situate away from potentially sensitive receptors. • Where stockpiles are too large to cover, alternative dust suppression measures (i.e. spraying with water to dampen surface) to be employed. • Temporary wind barriers will be employed when needed. • Review weather updates, to give warning of likely strong winds to assist with management of windblown dust.	Visual monitoring of dust emissions. To be monitored quantitatively if generation is considered to be excessive or complaints are received.	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• All haulage vehicles are to have their loads covered at all times when leaving site. • A meteorological station will be installed to provide continuous measurement of wind speed and wind direction. • Workers at risk to be provided with Respiratory Protective Equipment (RPE) or face masks during dust generating activities and elevated PM events or when standards are exceeded. • Damping down of construction roads will be undertaken twice daily as a minimum. This may need to be increased at times should the particulate standards be exceeded. • Dust arising from transfer of dry materials to/from stockpiles must be controlled by damping of materials to avoid wind-blown dust into areas where workers are present.		
Vehicle movements on unpaved tracks	Increased suspended particles in air and dust deposition	Minor	• Same as above	Same as above	EPC Contractor
Use of vehicles, mobile equipment and fuel driven plant	Increased concentration of gaseous pollutants from fuel combustion and VOCs	Minor	• The use of diesel power generators will be limited as much as possible. • Appropriate work schedules and methodologies will be developed to avoid double handling of activities and minimise emissions.	Visual assessment of emissions to be undertaken on a daily basis while vehicles and equipment are in use and annual inspection of vehicles. This will include	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Instructions will be provided to operators to turn off equipment when not in use. • Cleaner types of fuel will be used where possible (i.e., low sulphur diesel, ultra-low sulphur diesel fuel). • Equipment will be installed with pollution control devices such as diesel oxidation catalyst or particulate filter where feasible. • Appropriately sealed containers will be used for storing fuel and chemicals to control VOC emission. • Adequate ventilation will be provided in work areas where volatile materials will be handled. • Construction vehicles and machinery on site will be maintained regularly. • Open burning of construction waste is strictly prohibited.	an inspection during the initial acceptance criteria of such vehicles to site.	
Use of temporary sanitation facilities and wastewater containment structures	Odour from sanitary wastewater (in the event of inadequate wastewater management)	Negligible	• Portable toilets, sewage storage tanks and waste storage facilities will be placed away sensitive receptors. • Toilets and septic tanks will be adequately maintained and frequently cleaned. Leaks will be fixed as soon as possible. • Waste bins holding putrescible waste will be covered to minimise odour emission and attraction of vectors. • Regular off-site disposal of waste will be arranged by a service provider licensed by the Centre of Waste Management.	Daily olfactory observations – as part of maintenance and inspection checks	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
Waste Management					
Generation of non-hazardous construction wastes	Strain on existing waste facilities due to generation of non-hazardous solid construction wastes	Moderate	• Implement the following waste minimisation program / measures: • Efficient design, procurement and materials management; and • Procurement policies. • Reuse and recycle waste, where possible. • Segregate waste at source (where possible) and allocate suitable waste containers. • Provide waste management facilities onsite, including suitable waste containers / bins. Food waste bins to be provided with lids. • Label waste bins / containers and storage areas, in Arabic, English and Urdu (as a minimum). • Locate waste bins / containers strategically (e.g. work areas, rest areas, canteen). Waste containers / stockpiles to be located away from sensitive areas. • Restrict access to waste storage areas / facilities, with warning signs put in place. • Preference of materials with minimum packaging. • Arrangements with the suppliers for the return or buy-back of containers and packing materials. • Preference for pre-fabricated / pre-casted structure or materials. • Preference for environmentally friendly materials, such as those that are wholly or partly recycled.	Keeping records of actual materials consumed against Bill of Quantities. This will assist in determining whether there was unnecessary wastage. Maintaining waste inventory. Check waste storage areas containment and control procedure. Ensuring engaged contractors, their vehicles and waste management facilities have applicable registrations/licenses at time of procurement. Record keeping of waste transfer notes including waste sent to recycling facilities.	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Re-use of excavated materials for fill purposes during site development or foundation works, ensuring that materials are geotechnically suitable for purpose, • Use of scrap materials such as wood and metals for temporary structures on-site. Drip trays could also be made from scrap metal sheets. • Recycling of concrete waste and washings. An arrangement where such waste can be sent back to the supplier / concrete batching plant for recycling will be considered. • Recycling through EAD/ADM approved service providers. Where possible, paper, wood, metal and plastic wastes will be sent to suitable recycling facilities.		
Generation of hazardous construction wastes	Strain on existing waste facilities due to generation of hazardous construction wastes	Moderate	• Maintain a log / inventory of hazardous wastes and where possible look to substitute / minimize the product or process producing the waste. • 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.	As above	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Arrange for regular collection of hazardous waste for offsite disposal by suitably licensed ESPs.		
Generation of wastewater	Strain on existing wastewater treatment plants	Minor	• Provide a suitable temporary sewage holding tank onsite. • Arrange for regular collection of sewage for offsite disposal (i.e. sewage to be collected when tank is at 80 % of capacity) by ESPs. • Locate sewage storage tanks away from sensitive areas (e.g. site offices). • Truck washing (e.g., concrete / cement trucks) to be undertaken at designed bunded area. • Reuse / recycle equipment washings, for the same purpose as much as possible. • Consider undertaking washing / cleaning of equipment off-site. • Discharge of wastewater from washing to the marine environment will be prohibited. • Sewage will not be discharged into the stormwater network, ponds, or directly onto the soil to ensure prevention of environmental contamination and to comply with regulatory standards.	Visual inspection to check of wastewater storage locations for any signs of leak / spill and ensure that sewage tanks are in good condition.	EPC Contractor
Soil and groundwater					
Levelling of existing ground and earth movement	Change is site topography and physical alteration of surficial soils resulting from	Moderate	• Limit the extend of site grading and levelling as much as possible and limited to the project area.	None	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
	earthworks within the Project footprint				
Transfer, storage of hazardous material, chemical material and hazardous waste	Contamination of soil and groundwater due to unplanned events such as accidental spills, leakages, and uncontrolled disposal of chemical products and wastes	Minor	• Volumes of inventory of fuel/chemical on site should be at minimum, as far as possible. • All high-risk areas including fuel storage areas will be secured with internal fencing and patrolled by security throughout the day and night. • Fuel and chemical storage area should be provided with impermeable surface and secondary containment. The containment area should be designed to contain 110% of the capacity of the biggest storage tank on site (as per USEPA requirement). All fuel and chemical storage areas should be placed away from marine area. • Storage scheme as per Safety Data Sheet (SDS) requirements (i.e., considering computability, flame retardant storage, etc., as relevant). • Maintaining a chemical register and accompanying SDS, etc. • Drip trays should be provided at fuel/chemical transfer points and refuelling areas. Spill containment kit and equipment should be provided at fuel storage areas. • Spilled chemicals/oil should be collected immediately (including the	Visual inspection of bunded area(s). Visual inspections of refuelling area to ensure the mitigation measures are implemented. Visual inspection of storage facilities for any signs of spill or leakage. Record incidence of spill and leakage including actions undertaken.	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			contaminated soil) and disposed-off as hazardous waste. • Training workers on correct transfer and handling of fuels and chemicals and on the appropriate response to spills. Chemical handling and access to storage should be limited to authorized personnel only. • Emergency Spill Response Plan should be developed and implemented to control the spill and isolate the spill area. • Monitoring wells to be installed for periodic water testing and level measurements.		
Groundwater dewatering	Localized drop in static groundwater levels	Minor	• Dewatering operations should be undertaken through licensed contractors. • Dewatering effluent should not be pumped directly into slopes, use of a settlement tank is recommended. • Dewatering operation will be appropriately planned to avoid any erosion or ground instability. • In case of discharge onto land, it is recommended that a dewatering disposal pond be constructed to avoid unnecessary flooding. • All equipment will be appropriately maintained to avoid contamination of dewatering effluent. If any oil or grease contamination is observed, operation should be immediately stopped.	None	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• The option of using dewatering effluent for dust suppression should also be explored. • The settlement tanks used during dewatering should be subject to routine inspection and monitoring. • Dewatering will be carried out as per permit conditions and following EAD technical guidance document for Best Environmental Practices for Construction Environmental Management Plans. • If dewatering discharge is to land, a disposal pond will be constructed within the site to prevent flooding and will be communicated to EAD prior to start of dewatering. Such pond will only be used to store dewatering water; discharging any other types of wastewaters, including but not limited to sewage, is strictly prohibited. Additionally, the dewatered water intended for dust suppression should be tested to ensure it does not contaminate the soil.		
Terrestrial Ecology					
Early works including site preparation, grading and excavation	Direct loss of habitat and flora within Project footprint	Major	• Ensure that the construction activities are taking place only within the Project footprint. • EPC contractor staff will be strictly instructed to avoid removing any vegetation outside of the construction footprint. • Where areas of *Panicum turgidum* (Near Threatened) are located on site, a reasonable amount of topsoil will be collected prior to earthworks (to maintain	Following STL translocation activities (as per translocation plan – to be developed separate to the ESIA), there will be a monthly post-translocation monitoring of translocated STL individuals and other ecologically important	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	Monitoring Program Description	Responsible Party for Monitoring
			the seed bank) and stored for re-spreading in disturbed areas of the site (not subject to project structures) following the completion of construction. • A pre-construction summer season survey for Spiny-tailed lizards is being undertaken to mark all active burrows on the site. Further to this survey, a translocation plan will be prepared to specify methods for STL translocation, including details of suitable recipient site habitat to ensure impacts to this areas carrying capacity are not incurred. Further, the plan will specify on-going monthly monitoring to evaluate the success of translocation for individuals. • The translocation of spiny-tailed lizards will be conducted upon submitting and approving (by EAD) of the above-mentioned translocation plan, and before conducting any construction works including but not limited to levelling or excavation works. • Implement a catch and release plan for other fauna species (reptiles) with relocation to a similar habitat which has been surveyed and found suitable for translocation. • Project staff are to receive awareness training on the conservation value of habitats and key species (see below) within the Project site and its surroundings. The training will include the need to notify the relevant staff in case of a chance observation of fauna during construction (for translocation off-site at that time).	faunal species for a duration of 2 years. On-going visual observations will be made by site staff in case of chance finds of species that may require relocation during the construction phase (such as those that are trapped on-site).	

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
Early works and general construction works including movement of vehicles	Mortality or disturbance to fauna within Project footprint	Moderate to Major	• Ensure that there is an internal process to ensure reporting sightings of incidental mammals and reptiles to EPC HSE Managers, so that impacts can be avoided (i.e., the animal is translocated). • Provide dedicated HSE training to all personnel working on site detailing importance of ecological protection and site speed limits. • Vehicular traffic to remain on established roads and traffic to maintain low speed limits to minimise chance of vehicle strike. • Establish a policy banning any form of hunting or harming animals.	As above	EPC Contractor
Noise generation	Disturbance to fauna, especially nesting birds.	Moderate	• Implement construction noise control measures outlined in the air quality and noise section respectively.	None	EPC Contractor
Construction lighting	Disturbance to nocturnal species	Minor	• All outdoor lighting, other than signs, will be limited to those required for safety and security • Design a lighting system to minimise light spill. • Minimise work undertaken at night to reduce the need for artificial lighting, hence reducing the impact on nocturnal species	Visual inspection of lighting system at night time.	EPC Contractor
Noise and Vibration					
Construction activities on-site (including temporary plant and use of	Increased noise influence at receptors	Minor	• Noise control measures will be prepared for implementation by the EPC Contractor as part of the CEMP.	Noise monitoring at baseline noise monitoring locations during day and night time hours	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
mobile equipment) and construction vehicle movement			• The highest noise emitting activities will be undertaken in a central site area, or within an enclosed structure. For example, fabrication of materials should be carried out away from the site boundaries and or within structures. • Consideration of noise fences, or other methods to attenuate construction noise, will be required close to non-mobile equipment such as generators or at boundaries for key receptors that may have higher assessed impacts. • The EPC Contractor will, at all times, carry out all work in such a manner as to keep any disturbance from noise to a minimum (by phasing noisy works). • When nosier activities are expected, notice will be provided to the sensitive receptors as early as possible (minimum one-week notice) and informed for how long such activities will likely last. • The impacted receptors will have access to a grievance mechanism in order to make any complaints regarding noise during the construction phase. • Plan and implement designated vehicle routes, parking locations, operating hours, and on-site speed limit. • Deploy regularly maintained fit for purpose equipment. • Mufflers, silencers, and acoustic enclosures will be fitted for stationary plant and equipment such as diesel generators.		

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Equipment will be maintained in good condition via regular service. • Machines to be operated at low speed or power (where practical) and be switched off when not being used. • Optimise the number of deliveries by amalgamating loads and scheduling arrivals within designated hours.		
Construction activities on-site (including temporary plant and use of mobile equipment)	Impacts from ground vibration	Negligible	• None	None	--
Traffic					
Increased vehicles on local road (particularly HGVs) including construction vehicles with abnormal loads	Increased potential for damages to roads and cause incidents and increased road safety risks to communities.	Moderate	• Avoiding materials delivery during traffic rush hours. • Arrangement for mass transport of workers to minimize trips and vehicles coming in and out of the site i.e. use of buses (where relevant). • Purchase of materials in bulk rather than in smaller batches that would require more frequent delivery or collection trips. • Where necessary, construction of temporary access roads to ensure the smooth flow of traffic. • Construction access road into the site will be clearly signposted. • All traffic incidents and near misses will be recorded and investigated with any necessary corrective actions taken including reporting to local police.	Record of deliveries including material delivered, time etc. Record of daily trips of workers to and from accommodation areas Visual monitoring of traffic condition.	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Prompt repair and maintenance works will be ensured to rectify any damages caused by construction traffic, in coordination with the relevant local authorities. • A traffic Management Plan will be developed to confirm the designated access routes, site entrance points, waiting and parking areas etc. The plan will outline how construction traffic will be managed to limit impacts upon local communities, on-site personnel, and other road users.		
Socioeconomics					
Project employment	Creation of employment opportunities and economic benefits	Beneficial Impact	• Provide prompt and just payment to workers. • Utilise the local labour force, where feasible.	None	EPC Contractor
Procurement of construction-related goods and services	Local procurement of supporting services	Beneficial Impact	• Prioritise local companies when sourcing construction materials and services.	None	
Generation of construction related noise emissions, dust and other air emissions.	Nuisance related to generation of dust, noise etc. affecting Project staff waste generation.	Minor	• Refer to air quality and noise mitigation measures	Refer to air quality and noise monitoring measures	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
Community Health, Safety and Security					
Influx of workers	Conflict, communicable disease spread, sexually transmitted diseases etc.	--	• The Project Company will ensure that the EPC Contractor implements Influx Management mitigation which will be aligned with the applicable ESMS plans and procedures such as Local Recruitment Plan, Security Management Plan, Worker Code of Conduct, Accommodation Management Plans. • The project will implement an appropriate Grievance Redress mechanism (as part of the SEP) to allow external parties to raise grievances in regard to the project • The Health and Safety Teams will provide staff with training/inductions on exposure to diseases. • During construction, staff will have access to medical professionals and suitable medical facilities, which will aim to prevent the spread of diseases internally and externally. • Any reportable disease will be diagnosed by the authorised occupation and health centre doctor. Diagnosis will include identifying any new symptoms or any significant worsening of existing symptoms. • Any external or internal spreading of diseases will be diagnosed and precaution will be taken as per the instructions from the national/local medical authority.	Records of the illnesses the workers are suffering from and an analysis of top diseases. Record of human rights violation/complaints from the local receptors. Recording the number of influx related grievances received. Recording the number (per type) of grievances related to local community health, safety and security (injuries, damage, diseases, etc.);	EPC Contractor
	Increased pressure on public infrastructure	--			EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
Construction activities	Exposure of nearby receptors such as camel farms workers to construction and commissioning hazards	--	• Risk to public safety will be appropriately addressed and prepared for in the construction phase 'Emergency Preparedness and Response Plan' and training. • The plan will include the appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be required. • All high-risk areas including fuel storage areas will be secured with internal fencing and patrolled by security throughout the day and night. • Appropriate mechanisms for emergency control (e.g., firefighting equipment) will be placed at accessible positions around the site.		EPC Contractor
Movement of construction vehicles	Increased potential for damages to roads and cause incidents and increased road safety risks to communities.	--			EPC Contractor
Project security	Use of excessive force by security providers	--	• All vehicles entering the site will require pre-approved clearance and will need to be registered. • The project's security will record all instances of incoming vehicles. • CCTV will be installed at key locations around the site and at the gatehouse. • Project security will be stationed at the main gate at all times, with patrolling at night. • Appropriate lighting will be provided at the gatehouses to allow proper screening of personnel at night. • Project personnel will only be provided access to the construction site with valid		EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	Selected Mitigation Measures	Monitoring Program Description	Responsible Party for Monitoring
			ID cards and permits to work in line with EHS requirements. • The project will implement an appropriate Grievance Redress mechanism to allow external parties to raise grievances in regards to the project. The Grievance Mechanism will be designed to allow engagement of applicable project stakeholders. The mechanism will be clearly defined, transparent and accessible to stakeholders.		
Labour and Working Conditions					
Construction activities	Occupational health and safety risks	Minor to Major	• The EPC Contractor will provide the workers with a safe and healthy work environment, considering inherent risks and specific classes of hazards associated with the project. • The EPC Contractor will implement and maintain and OHS management system considering 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 recognised international best practice and as a minimum, this plan will include; – Means of Identifying and minimising, so far as reasonably	Records of contracts, payments, receipt of benefits, leave entitlements, retrenchment etc. Record the number of women employed in the project including their rank and renumeration compared to men occupying the same positions. Inspections of Sanitation Facilities, Office Spaces, Welfare and Rest Areas using a checklist as per	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			practicable, the cause of potential H&S hazards to workers. – Provisions of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. – Provision of appropriate equipment to minimise risks, and requiring and enforcing its use. – Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. – Documentation and reporting of occupational accidents, diseases and incidents. – Emergency prevention, preparedness and response arrangements.	IFC & EBRD and national standards.	
	Inadequate working conditions – discrimination and unequal opportunities	Moderate	• 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. • 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 employment relationship, including recruitment and hiring, compensation (including wages and		EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	Selected Mitigation Measures	Monitoring Program Description	Responsible Party for Monitoring
			benefits), working conditions and terms of employment, accommodation, 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). • 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 discriminatory		
	Working conditions – forced labour.	Moderate	• 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,		EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			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. • The EPC will only engage recruitment agencies that are registered in their country of operations and have a good track record i.e., have no court cases.		
	Working conditions – child labour.	Moderate	• The EPC Contractor will comply with all relevant national laws' and lenders provisions related to the employment of minors. • The EPC Contractor will devise a management procedure to ensure that all workers are above the minimum legal age of employment at the time of hiring. This will include the verification of official personal registration documents i.e., national ID, passport etc. • In any event, the EPC Contractor 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		EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			18 will be subject to an appropriate risk assessment.		
	Impacts related to lack of worker representation and restrictions on trade union.	Minor	• HR Policies will consider the ability of workers to elect representatives without discrimination or risk of retaliation. • Ensure policies allow workers to raise collective grievances via the Project's grievance mechanism.		EPC Contractor
	Impacts related to compulsory overtime and job security.	Moderate	• 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).		EPC Contractor
	Impacts due to inadequate workers accommodation.	Moderate	• Worker accommodation areas will be managed in accordance with the EBRD and IFC Workers' Accommodation: Processes and Standards. • Implementation of the Worker Accommodation Plan.	Inspection/internal audit of worker accommodation facilities vs. IFC & EBRD and national standards	EPC Contractor
	Lack of access to grievance mechanism	Moderate	• 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 will involve an appropriate level of management and	Grievances including those relating to gender-based violence and harassment. Human rights complaints/violations as reported by Project	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			address concerns promptly, using an understandable and transparent process that provides feedback to those concern without 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 including workers hired through third-parties or in the supply chain	
Landscape and Visual					
Construction activities including presence of plant and equipment	Change in Landscape Character – Gravel Plains	Minor	• Land clearance and construction works will be limited to within the Project boundary. • All temporary construction facilities will be removed upon completion of construction activities and the areas restored in line with the Habitat Restoration Plan. • Local communities will have access to a grievance redress mechanism.	None	EPC Contractor
Construction activities including presence of plant and equipment	Change in Landscape Character – Gravel Plains	Moderate	Same as above	None	EPC Contractor
Construction activities including presence of plant and equipment	Reduction in Visual Amenity - Residential	Moderate	• The EPC will select PV modules designed to reflect as little light as possible (modern PV panels can have less intense reflectivity than still water – World Bank 2019).	None	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Where appropriate, construction laydowns and working areas of the site will be screened to reduce the visual intrusion to existing off site receptors. • Minimise construction works at night-time to those strictly required and approved by the relevant authorities through issuance of night permits. • Local communities will have access to a grievance redress mechanism. • When not in use, cranes and other construction plants shall be lowered, so they are at their minimum height and do not protrude unnecessarily within the visual envelope of local receptors. • Mitigation and management measures relating to the generation of dust (as detailed in Section 5.1 Air Quality) shall be implemented to minimise visual impacts during construction activities. • Any floodlights required during nighttime construction activities will be directed onto the working areas, with a maximum position angle of 30° from vertical, and back spill shields, therefore minimising any unwanted light spill.		
Construction activities including	Reduction in Visual Amenity - Agricultural	Minor	Same as above	None	EPC Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
presence of plant and equipment.					

Table 2-2 Impacts, Mitigations and Monitoring Summary – Operation Stage

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
Waste Management					
Commissioning and operational activities involving the generation of hazardous wastes.	Strain on existing municipal waste management facilities due to generation of non-hazardous wastes	Minor	• Operator to develop and implement a Project-specific Operations Waste Management Plan (OWMP) in line with committed mitigation measures in this ESIA report and the provisions of the OEMP. • Waste containers/skips should be clearly labelled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required. • For litter (food waste, domestic waste), an adequate number of covered bins should be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. • Paper cardboard, metal cans, plastic, glass to be collected for recycling by an EAD approved waste contractor. • Only licensed waste transporters and waste management facilities will be engaged. • The Plant will maintain copies of the waste management licensed on site. • Completed waste manifests are required to show the chain of custody of the waste generated on-site, its	Record keeping of waste transfer notes including waste sent to recycling facilities. Visual inspection of waste storage areas	O&M Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			transportation and treatment/disposal. All records will be maintained on-site.		
Operation of Plant offices and welfare facilities.	Strain on existing wastewater treatment plants	Negligible	• Sanitary facilities should be provided with adequately designed underground storage tanks. • Sanitary wastewater tanks to be properly maintained and inspected to ensure tanks do not overflow. • Engage approved waste contractor for the periodic removal of the tank. • Sanitary wastewater tanks in allocated impervious hard standing areas with a bunding capacity of 110% volume of the maximum volume stored.	Same as above	O&M Contractor
Plant operation	Strain on waste facilities due to generation of hazardous wastes including broken PV panels	Minor	• Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments. • Segregate and identify hazardous waste from the other waste streams into separate waste containers/skips signed and labelled. • Store hazardous waste (including broken PV panels) in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition.	Same as above	O&M Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Waste containers should be marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Wherever possible, chemicals will be kept in their original container. • Broken PV panels will be shipped to an authorised company for recycling.		
Soil and groundwater					
Generation of operational wastes / Risk of Spillage	Impacts from inadequate handling and storage of operational wastes	Negligible	• The integrity of all storage tanks and bunds to be tested and inspected for leaks and flaws. • All high-risk areas including fuel storage areas will be secured with internal fencing and security throughout the day and night with random patrolling at night time. • Storage of all fuel/chemical or other hazardous liquid/waste tanks shall be on an impermeable base with liners and/or secondary containment with enough capacity to hold 110% of the maximum volume stored. • Where multiple containers are stored, the bund capacity shall be suitable to contain 25% of the volume of all containers. • Operator to develop and implement an Emergency Response Plan (ERP) to include or link to a Spill Response and Contingency Plan. • Personnel in contact with such materials shall be trained on emergency and spill	Visual inspections of waste storage areas	O&M Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			response, containment, material handling and storage procedures. • Availability of suitable containment and spill clean-up materials/equipment at specific locations within the Project site. • Conformance with ERP procedures (preventative and response) will be monitored through routine inspections. • Loss of containment to be reported promptly. This should be investigated to confirm the cause and appropriate corrective/preventative actions put in place.		
Terrestrial Ecology					
Operational vehicles movement	Mortality or injury to fauna	Minor	• Ensure strict speed limits for vehicles • Ensure there is an internal process to ensure sightings of mammals and reptiles are reported to the O&M HSE Manager to avoid impacts. • Educate workers on the sensitivity of the nearby desert environment (e.g. through EHS induction and regular toolbox talks).	Visual site inspection to check for any species onsite.	O&M Contractor
Noise					
Operation of plant including vehicle movement	Impacts from increased noise during plant operation	Negligible	• Timely maintenance of operational vehicles as per manufacturer instructions. • Ensure speed limits at Plant access roads and public roads are adhered to by drivers.	None	O&M Contractor
Community Health, Safety and Security					
Plant operations	Emergency situations (e.g., unplanned	--	• Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency	As per the Operational Standard Procedures and Readiness as per	O&M Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
	events such as fire, explosion etc.)		Preparedness and Response Plan' and training. • The plan will include appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be queried. • All high-risk areas including fuel storage areas will be secured with internal fencing and will be patrolled by security throughout the day. • Appropriate mechanisms for emergency control (e.g., firefighting equipment) will be placed at suitable positions around the site. • The plant will have various mitigation controls to protect against spillage of hazardous liquids and materials, including fuels.	Emergency Response Plan	
Project Security	Use of excessive force by security providers during operation	--	• All vehicles entering the site will require pre-approved clearance and will need to be registered. Project security will record all instances of incoming vehicles. • CCTV will be installed at key locations around the site and at gatehouses. • Project security will be stationed at the main gate at all times, with occasional patrolling at night. • Appropriate lighting will be provided at gatehouses for security personnel to prevent unauthorised access. Project personnel will only be provided access to the site with valid ID cards and	None	O&M Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			permits to work in line with HSE requirements.		
Labour and Working Conditions					
Plant Operation	Occupational health and safety risks	Minor to Major	• The O&M Company will provide the workers with a safe and healthy work environment, considering inherent risks and specific classes of hazards associated with the project. • The O&M Company will implement and maintain an OHS management system considering specific risks associated with the project, legal requirements and duty of care. • The O&M Company will be responsible for ensuring all affiliated sub-contractors comply with the OHS management system. The OHS management system will be in-line with recognised international best practice and as a minimum, this plan will include; – Means of identifying and minimising, so far as reasonably practicable, the causes of potential H&S hazards to workers. – Provisions of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. – Provision of appropriate equipment to minimise risks, and requiring and enforcing its use.	Monitoring as per the operational H&S Plan	O&M Contractor

Project Aspect (Source of the Impact)	Environmental Impact	Impact Significance	selected mitigation measures	monitoring program Description	Responsible Party for monitoring
			• Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment.		
Landscape and Visual					
Presence of the PV plant	Change in Landscape Character – Gravel Plains	Negligible	• The operational phase team will ensure that the habitat restoration undertaken at the end of the construction phase is maintained during the operational phase.		O&M Contractor
Presence of the PV plant	Change in Landscape Character – Sand Sheets	Minor	Same as above		O&M Contractor
Presence of the PV plant	Reduction in Visual Amenity - Residential	Moderate	• Lighting provisions will comply with Health & Safety requirements, but not be excessive or unnecessary and not result in sky glow, light spill, and glare effects. • Light fittings shall be directional as deemed appropriate for their use and intended areas of illumination. • Lighting column and lighting head design will be chosen to limit back spill and any unwanted light spill to other site areas or areas off the site.		O&M Contractor
Presence of the PV plant	Reduction in Visual Amenity - Agricultural	Minor	Same as above		O&M Contractor

2.1 Human Rights Impacts Assessment

Potential risks to human rights were assessed as part of the ESIA. This assessment included evaluating risks related to the following during construction and operation:

- Forced labour and poor working conditions
- Discrimination
- Wages, working hours, right to rest and end of service benefits
- Child labour
- Gender based violence and harassment
- Workers union and collective bargaining
- Freedom of movement
- Project security and use of excessive force by security personal
- Health conditions
- Occupational health and safety

Potential human rights at risk were screened for applicability to the Project using the International Covenant on Civil and Political Rights (ICCPR) and International Covenant on Economic, Social and Cultural Rights (ICESCR).

A number of relevant stakeholders, including duty bearers and rights-holders responsible for ensuring human rights during project execution, have been identified. These stakeholders include government and regulatory entities, the Project Company and its contractors (EPC and O&M), visitors, project lenders, and primary material suppliers.

Based on the screening and assessment conducted as part of the Human Rights Impact Assessment, almost all of the identified risks are considered low. The risks are unlikely to occur, and if they do, they can be eliminated or mitigated through the implementation of appropriate mitigation, management, and monitoring measures. The only potential high risks are related to establishing workers' unions and collective bargaining, which are not provided for under UAE labor law. However, provisions under the Ministry of Human Resources of the UAE allow both private sector employees and employers to register labor-related complaints through a centralized government system, including for collective labor disputes.

Additionally, Occupational Health & Safety is considered a high risk that will require further and specific risk assessment and management by the project's relevant H&S staff.