Sherabad Solar PV Project

Environmental and Social Impact Assessment Report

Masdar

January 2023

Quality information

Prepared by	Checked by	Approved by
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1.0	16 Sept 2022	Draft for Client	Y	Iain Bell	Regional Director
1.1	22 Sept 2022	For Client	Y	Iain Bell	Regional Director
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Definitions

Term	Definition
AOI	Area of influence. The AOI (based on the definition in IFC PS1) adopted by the Project is: • The area likely to be affected by: – Project activities and facilities that are directly owned, operated, or managed (including by contractors) by the Project Proponent and that are a component of the Project; – Impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location; or – Indirect Project impacts on biodiversity or on ecosystem services upon which 'Affected Communities' livelihoods are dependent. • Associated facilities, which are facilities that are not funded as part of the Project and that would not have been expanded if the Project did not exist and without which the Project would not be viable. It is anticipated there will not be any associated facilities for the Project; and • Cumulative 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.
Affected communities	Local communities who are directly impacted by the Project.
Developer	Masdar, Abu Dhabi's (UAE) renewable energy company specialising in the development, commercialisation, and deployment of clean technologies across utility-scale plants, off-grid projects and sustainable real estate.
Project	A 456.7 MWac solar PV facility in the Sherabad district, Surkhandarya region of the Republic of Uzbekistan, complete with 220/110/10 kV substation and a 50.43 km transmission line to the Surkhan 220 kV substation.
Project Area	The geographic area comprising the Project Site and its immediate surroundings.
Project Site	The Solar PV Site and overhead line grid connection
Solar PV Site	The land within which the solar PV panels and associated equipment will be located. It excludes the overhead line grid connection.
Study Area	
MWac	Megawatt of AC power, measurement of installed capacity of the solar PV facility.
AC	Alternating current
PV	Photovoltaic (the conversion of sunlight into electrical energy)

1. Introduction

1.1 Project Overview

This report covers the development of a 456.7 MWac solar PV project in Sherabad District, Surkhandarya region of Uzbekistan, referred to as "the Project". The Project site area is 631 ha. The Project will also comprise a 50.5 km overhead transmission line from the on-site substation to the existing substation.

The generation of a minimum 456.7 MWac of renewable energy, which is expected to provide clean energy to approximately 500,000 households in the Surkhandarya region.

Table 1. Key Project characteristics

Location	Sherabad District, Surkhandarya region, Republic of Uzbekistan
Installed capacity	456.7 MWac
Solar PV Site area	631 ha
Overhead grid connection line	50.50 km 220 kV Steel lattice towers
National grid substation	Surkhan substation is located in the Jarkurgan district

Table 2. Emissions Reduction

PROJECT ANNUAL ELECTRICITY GENERATION (KWH)	1,114,386,000
NUMBER OF HOUSES POWERED BY THE PROJECT	495,283
EMISSION REDUCTIONS OF CARBON DIOXIDE ANNUALLY (TONNES/YR)	445,754

Further details about the Project design, construction and operation are provided in Chapter 2 Project Description.

1.2 Purpose of this Report

The purpose of this ESIA Report is to:

- Identify the likely key environmental and social issues associated with the Project in order to focus the ESIA.
- Frame the scope for the baseline studies that support the ESIA.
- Document legislative requirements of Uzbekistan for this type of project.
- Describe the methodology and approach to be used in assessing impacts.
- Undertake an environmental assessment of potential impacts.
- Describe the mitigation methods
- Assess the residual impact of the Project.

This Report has been prepared as part of the ESIA process following internationally accepted standards.

1.3 National OVOS

To satisfy the statutory requirements of the Republic of Uzbekistan, a separate national Environmental Impact Assessment (OVOS) report was developed concurrently with the international ESIA report. The ZVOS has been submitted and has been approved.

1.4 Project Team

1.4.1 Developer

The Project is being developed by Masdar (Abu Dhabi Future Energy Company PJSC). Masdar has been selected through a competitive tender set up by the Ministry of Investment and Foreign Trade, the Ministry of Finance, and the Ministry of Energy with assistance from the International Finance Corporation (IFC).

Masdar A MUBADALA COMPANY

Masdar is a global leader in renewable energy and sustainable urban development, with headquarters in Abu Dhabi. Over the past decade, Masdar have pioneered commercially viable solutions in clean energy, sustainable real estate and clean technology in the UAE and around the world.

1.4.2 ESIA Consultants

The Developer has commissioned AECOM to lead the Project ESIA study, ESIA consultation and ESIA reporting.

AECOM

AECOM is a global leading engineering and environmental consultancy providing professional technical and management support services to a broad range of markets including power and renewables, with experience supporting more than 15 gigawatts in solar power around the world.

Green Business Innovation

AECOM has partnered with Green Business Innovation, a leading environmental consultancy based in Uzbekistan, who will lead the field surveys and stakeholder engagement for the ESIA.

1.5 Report Structure

This Report comprises the following sections, as outlined in Table 3.

Table 3. Report Structure

Chapter	Contents
1. Introduction (this chapter)	An overview of the Project, purpose and structure of this report, and the Project team.
2. Project Description	Description of the proposed facilities and structures, construction methods, power plant operation, anticipated waste streams and other key aspects of the Project.
3. Legal and Policy Framework	Summary of legislation, regulations, policies and plans applicable to the environmental and social aspects of the Project.
4. Impact Assessment Methodology	Description of the approach to determining receptor sensitivity, impact magnitude and overall impact significance, as well as mitigation hierarchy.
5. Stakeholder Engagement	Summary of the aims, approach and process of Project stakeholder engagement.
6. Environmental and Social Baseline	Description of environmental and social baseline (pre-Project) conditions.
7. Potential Environmental and Social Impacts	Overview of the potential environmental and social impacts that could be caused by Project construction, operation and decommissioning.
8. Mitigation	Summary of the mitigation measures put in place to mitigate the identified impacts.
9. Residual Impacts	Summary of the residual impacts following mitigation.
10. References	

2. Project Description

2.1 Location

The solar project site is located in the Sherabad district of Surkhandarya province. The new transmission line will run across Sherabad, Kizirik and Jarkurgan districts of Surkhandarya province, while the existing Surkhan substation is located in the Jarkurgan district.

The Project Site area is approximately 631 ha.

The overhead transmission line route is 50.5km, connecting the Project to the existing national grid substation Surkhan.

Figure 2-1. View from the centre of the eastern site

2.2 Solar Photovoltaic (PV) Technology

In general terms, solar PV technology converts the sun's energy into electricity using a series of solar panels, inverters and transformers to connect to the electricity grid.

PV cell technologies are broadly categorised as either crystalline silicon or thin-film. Crystalline silicon (c-Si) cells provide high efficiency modules. They are sub-divided into mono-crystalline silicon (mono-c-Si) or multi-crystalline silicon (multi-c-Si). Mono-c-Si cells are generally the most efficient but are also more costly than multi-c-Si. Thin-film cells provide a cheaper alternative but are less efficient. There are three main types of thin-film cells: Cadmium Telluride (CdTe), Copper Indium (Gallium) Di-Selenide (CIGS/CIS), and Amorphous Silicon (a-Si).

The performance of a PV module will decrease over time due to degradation. Degradation rate depends on the environmental conditions in the local area and the technology of the module.

Modules are either mounted on fixed-angle frames or on sun-tracking frames. Fixed frames are simpler to install, cheaper and require less maintenance. However, tracking systems can increase yield by up to 20%. Tracking, particularly for areas with a high direct/diffuse irradiation ratio, also enables a smoother power output.

The energy generated by the PV modules is then converted from direct current (DC) into alternating current (AC) electricity, conforming to the local grid requirements, by solar inverters. Inverters are arranged either in string or central configurations. String inverters enable individual string Maximum Power Point Tracking (MPPT) and require less specialised maintenance skills. String configurations also offer more design flexibility. Central configuration inverters are considered to be more suitable for multi-MW plants.

PV modules and inverters are all subject to certification, predominantly by the International Electrotechnical Commission (IEC). New standards are currently under development for evaluating PV module components and materials.

The performance ratio (PR) of a well-designed PV power plant will typically be in the region of 77% to 86% (with an annual average PR of 82%), degrading over the lifetime of the plant. In general, good quality PV modules may be expected to have a useful life of 25 to 30 years.

The main components of the solar PV Project are:

Solar PV modules: These convert solar radiation directly into electricity through the photovoltaic effect in a silent and clean process that requires no moving parts. The output from a solar PV cell is DC electricity. A PV power plant contains many cells connected together in modules which are then connected in strings to produce the required output.

Inverters: These are required to convert the DC electricity to alternating current (AC) for connection to the utility grid. Many modules in series strings and parallel strings are connected to the inverters.

Module mounting (or tracking) systems: These allow PV modules to be securely attached to the ground at a fixed tilt angle, or on sun-tracking frames.

Step-up transformers: The output from the inverters requires a further step-up in voltage to reach the AC grid voltage level. The step-up transformer takes the output from the inverters to the required grid voltage.

The grid connection interface: This is where the electricity is exported into the grid network. The substation will also have the required grid interface switchgear such as circuit breakers (CBs) and disconnects for protection and isolation of the PV power plant, as well as metering equipment.

Figure 2-2 shows the key principles and associated structures of a PV facility.

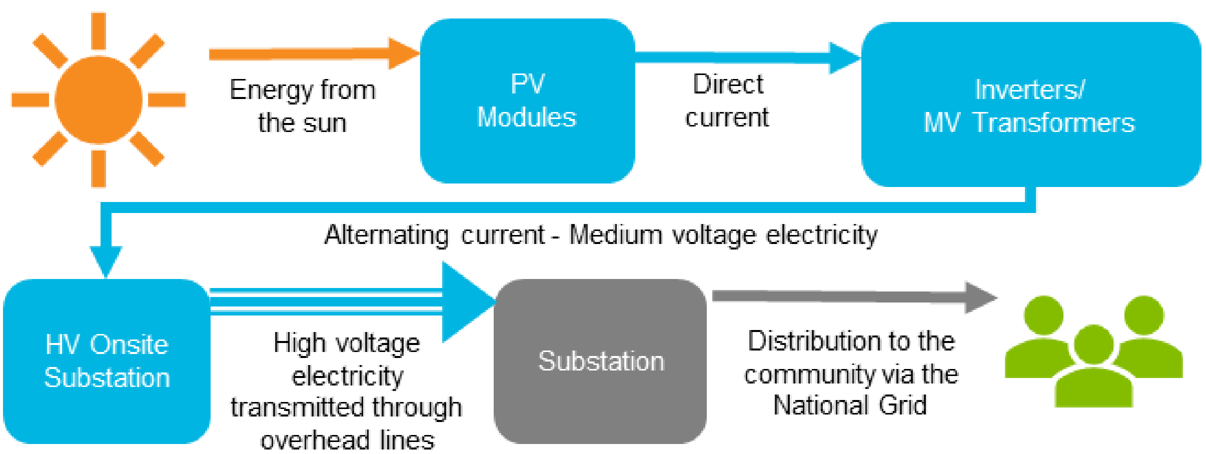

Figure 2-2. PV power plant overview

2.3 Project design

2.3.1 Solar PV Site Layout

Gated access to the facility will be located at the east side of the facility, as well as the temporary workers camp for the construction phase of the project. The project substation will be located towards the northwest boundary of the site. The proposed preliminary layout uses north-south orientated internal service roads, 5m in width, to access different inverters and areas of the PV plant and a few east-west internal service roads.

The initial layout is provided below and the final layout and detailed design will be provided by the EPC contractor during the detailed design phase of the Project. The design will take into account flood and erosion risk and consider future climate change.

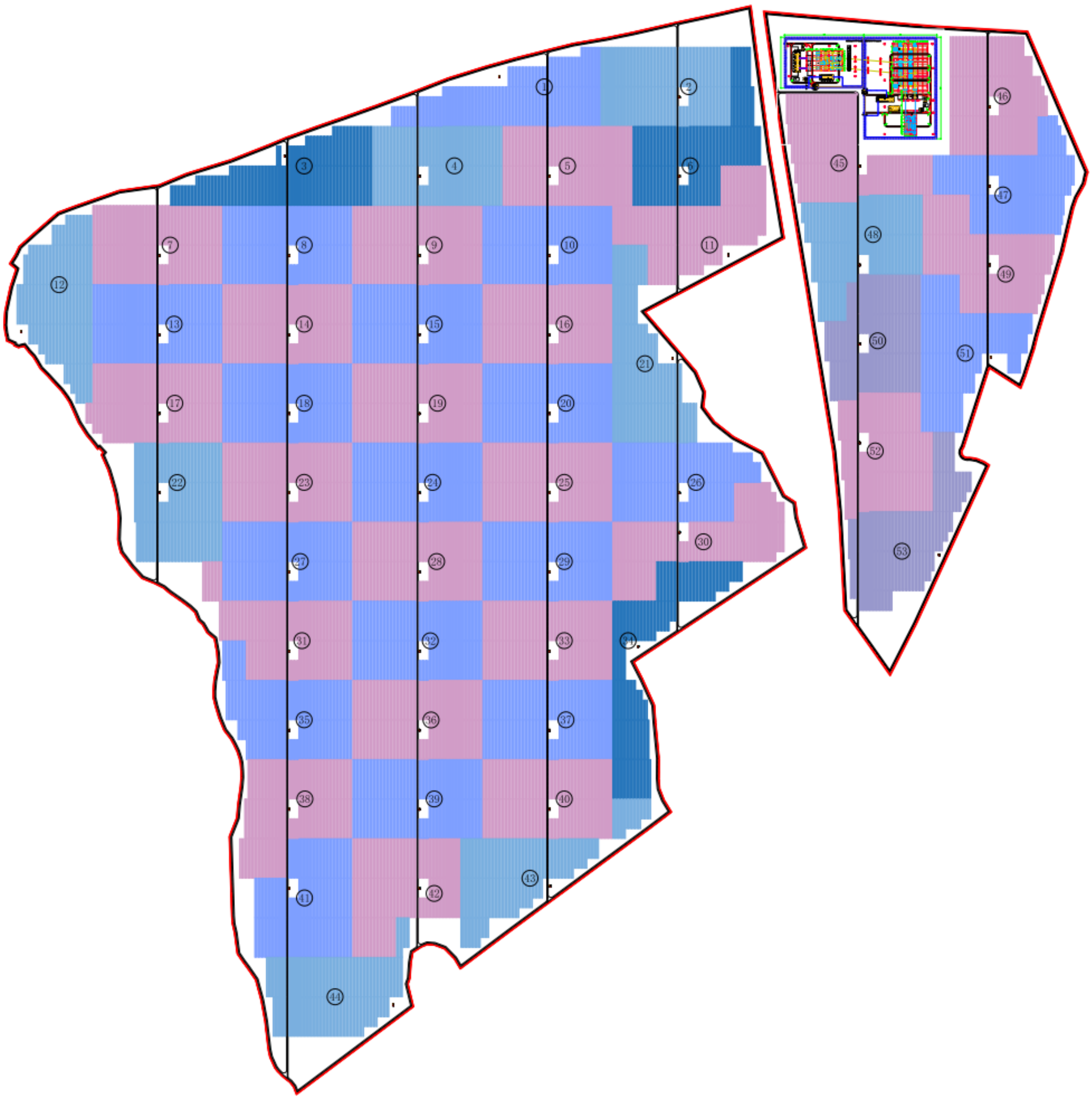

Figure 2-3. PV power plant layout

The key components and parameters of the site are summarised in the table below.

Table 4. Project components

Component	Value
Area of Project Site (Ha)	631
Materials for all fencing	Hot dip galvanized with adequate corrosion protection.
Fence posts and foundations shall be adapted to the ground conditions and at an interval (m)	3 maximum
Struts will be installed at (m)	20 maximum
Fence height with barbed wire (m)	2.5
Alarms	Remote alarms will be installed
Number of Closed-Circuit Television CCTV Cameras to be installed during construction	at least 10 Cameras
The land for the Site will be leased by Masdar for a period of up to (years)	30
Pre-construction and Construction Phase (duration) (months)	Up to 12
Operational Phase (PV Plant lifetime) (years)	30
Number of Jobs during the Construction Phase	Up to 1146
Number of Jobs during the Operational Phase	Up to 25
Installed Capacity (MWac)	456.7
Project Annual Electricity Generation (kWh)	1,114,386,000

Source: Masdar

2.3.2 PV Modules

The selection of the support system (with trackers or without), PV Modules and inverters will be carried out during the detailed design stage by the successful bidder and developer of the project. The proposed layout presented in this report uses north-south oriented panel arrays.

The current design envisages that the Project will comprise approximately 900,000 modules. These will be 570 Wp n-type mono silicon half-cell double glass modules.

The PV modules will be installed on a tracking system. A tracking system involves attaching the PV modules to a table that can move in relation to the sun. This allows for optimal performance throughout the day. The Project would utilise a single-axis tracking system, which tilts the solar panel around a horizontal axis thus tracking the sun's movement from east to west, as illustrated in Figure 2-4. The proposed tracker system parameters are as follows:

- Tilt range: +/-60 degrees;
- Height at maximum tilt: 2.5 m;
- Clearance above ground: 0.5 m; and
- Spacing between rows: 3 m.

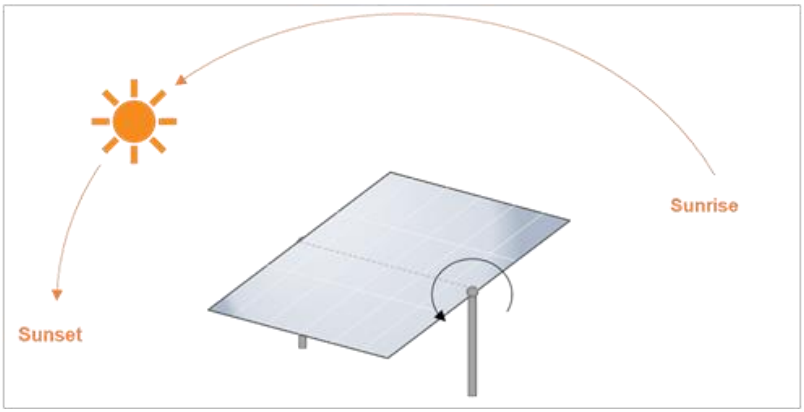

Figure 2-4. Schematic Diagram of Single-Axis Tracking System

2.3.3 Foundations

Foundation design can be categorised into three main groups: galvanised driven piles, ground screw piles, or concrete foundations. These designs are illustrated in Figure 2-5. Piles are typically installed to the depth of 2.5 m to 3 m below ground, whereas concrete foundation slabs are placed directly onto the ground.

The choice foundation is determined based on the substrate characteristics of a site (whether the ground is too soft, too rocky, contaminated or accessible by the drilling machines) and the expected wind loads in the area. The final choice of mounting structure and foundations may depend on the outcome of further geotechnical surveys and may comprise a combination of the foundation types.

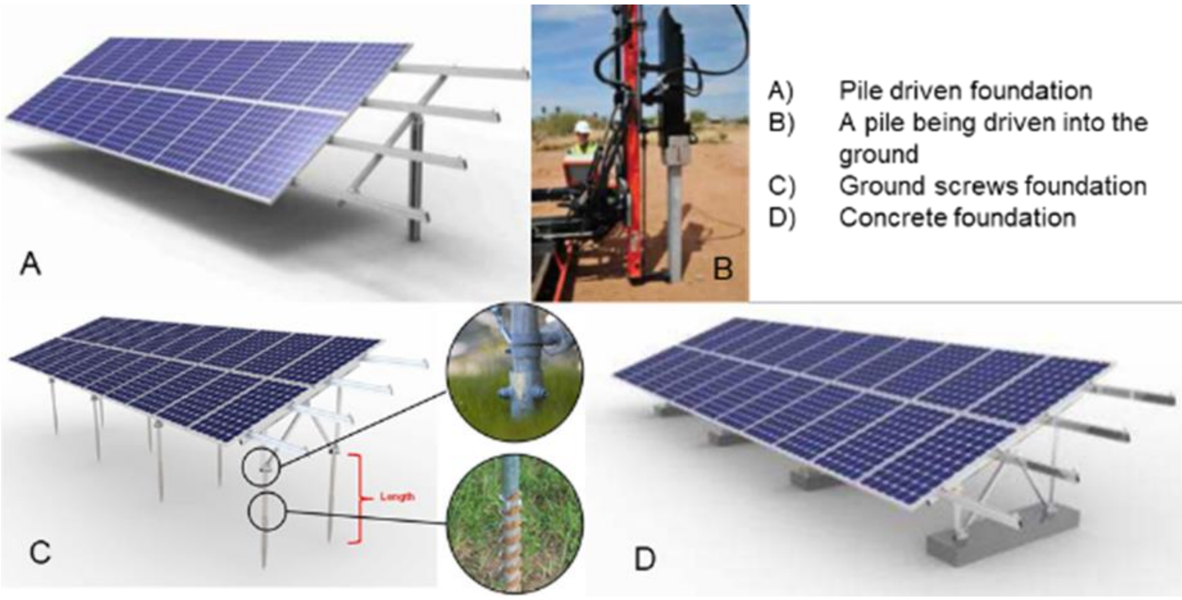

Figure 2-5. Foundation options

Source: ILF Consulting Engineers, 2019

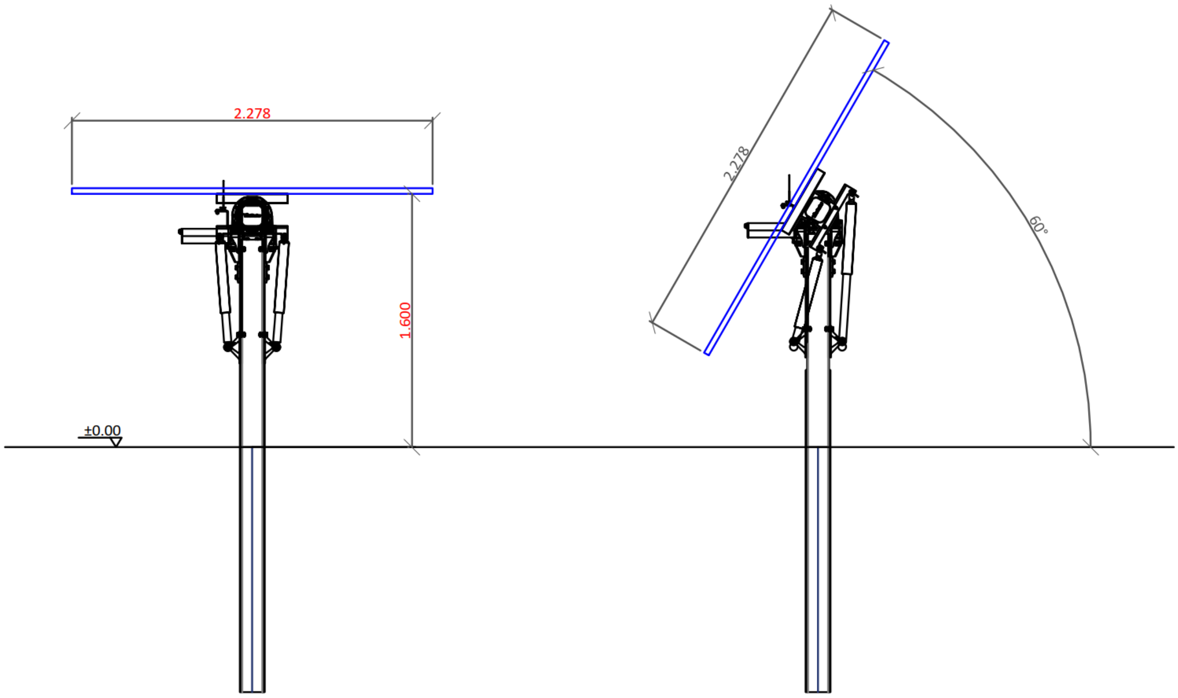

Figure 2-6. Tracker profile view

Based on the soil characteristics at the Project Site, a helical pile foundation system is recommended for the project[1]. Helical driven steel piles are one of the most cost-effective foundations on loose sands or silts, since the installation process induces a certain densification of the soil around the shaft. Moreover, combined with an appropriate drainage system and waterproof measures, it would be possible to mitigate the risk of collapse. Helical piles are manufactured foundation elements that consist of a steel pipe shaft with one or more helical plates welded to the bottom end of the shaft. The installation of helical piles is performed with conventional construction equipment, such as a skid steer, compact excavator, backhoe, etc. fitted with a high torque low speed hydraulic head.

The tower foundations will either be isolated footing or pile foundations. The final selection of foundation type shall depend on the tower type to be installed, tower mechanical stresses and characteristics and the geotechnical investigations. Based on AECOM's investigations to date, a layer of gypsum may be present at a depth of 1m below ground level. This shall be investigated further during detailed design.

The proposed facilities and auxiliary buildings can be supported by shallow foundations (typically spread footings or slabs) over compacted fill.

2.3.4 Inverters

The primary function of a solar inverter is to convert the direct current (DC) produced by the PV modules into an alternating current (AC), which is suitable for use by the new substation and eventual supply to the national grid. An inverter may be located in a decentralised fashion to service small arrays of PV modules (string inverter) or in a centralised fashion to service large arrays of PV modules (central inverter); nevertheless, the functionality of the inverters is the same.

A central inverter has a footprint of approximately 1–2 m by 2–3 m and is typically up to 3 m tall and has a noise emission rating in the order of 68 decibels (dB(A)) (SMA Solar Technology AG).

String inverters are smaller, approximately 1 m by 0.6 m and up to 1 m tall (Sungrow, 2019), and are generally quieter than central inverters. The Project will likely use string inverters, such as Sungrow String inverter SG250HX-IN-20. It is estimated that 2,076 string inverters will be required for the Project.

Figure 2-7. Central inverter (left) and string inverter (right)

Source: SMA Solar Technology AG

2.3.5 Cabling

Direct current cables, connecting several strings to a combiner box, will run along the back of the module substructure avoiding loops and will be stabilised by special clamps or ultraviolet-resistant cable conduits. DC main cables, connecting each monitor box with the inverter, will be placed underground within a pipe or a DC cable trench, buried 700 mm below ground and in a 600 mm width trench.

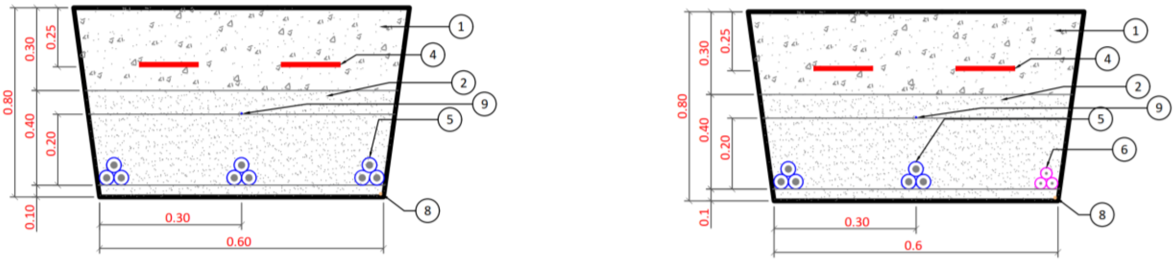

Figure 2-8. Cable trenches

2.3.6 Substation

The generation substation shall transform the generation voltage level (35kV) to the utility voltage (220kV) through two 60/76/100 MVA power transformers and the associated electrical devices. The substation will be air insulated, AIS, due to the normal climatic conditions and ambient pollution levels, with electrical devices mounted over metallic supports and interconnected with aluminium conductors.

The proposed arrangement shall include a single busbar with two-line bays, two transformer bays, two power transformers, and indoor MV systems. The power transformers shall have YNd11 connection groups, solidly grounded on the primary (HV) side and through an earthing reactor (zigzag transformer) on the secondary (MV) side. Connection of the solar PV plant shall be done in 35 kV. Medium voltage switchgears shall be indoor, gas insulated (GIS) type and with the required functions (transformer, feeders, auxiliary services, capacitor bank, etc). Switchgears might be extended in both sides and the MV room shall have enough free space for future expansions.

The substation shall have a control building to allocate the following systems:

- MV switchgears as described above.
- Protection and control panels and HMI.
- AC/DC auxiliary power supply panels.
- DC battery banks (in a separate room) and chargers. HOLD add capacity
- MV/LV transformer for auxiliary services.

- Telecom panels.
- Other service facilities (office, storage, toilets, etc.).

In addition, the substation will include:

A diesel generator installed close to the control building for emergency power supply. HOLD power rating of the generator; HOLD diesel storage type, volume, location.

Chain link perimeter fencing on all sides, swing gate with two leaves and standard industrial lock at the substation access road.

Crushed yard-stone a minimum of 6” thick shall be used throughout the substation area for electrical insulation. Where clay or other poorly draining soils are present, a 12” yard-stone thickness shall be used between the substation road and ditch. This additional thickness is provided to avoid ponding under the road. Yard-stone shall extend 5 m outside the perimeter fence on all sides.

The substation shall have lightning protection by installing lightning rods with Franklin points mounted on masts.

The transformer shall be mounted on a concrete mat with secondary oil containment which is critical for capturing oil spills and protecting the environment. Different approaches to the design concepts of secondary containment systems include individual pits around the transformer foundation sized to hold a volume equal to 110% of the transformer oil volume (to accommodate some precipitation), or a lined area around the transformer, with piped drainage to an underground storage tank/oil-water separator.

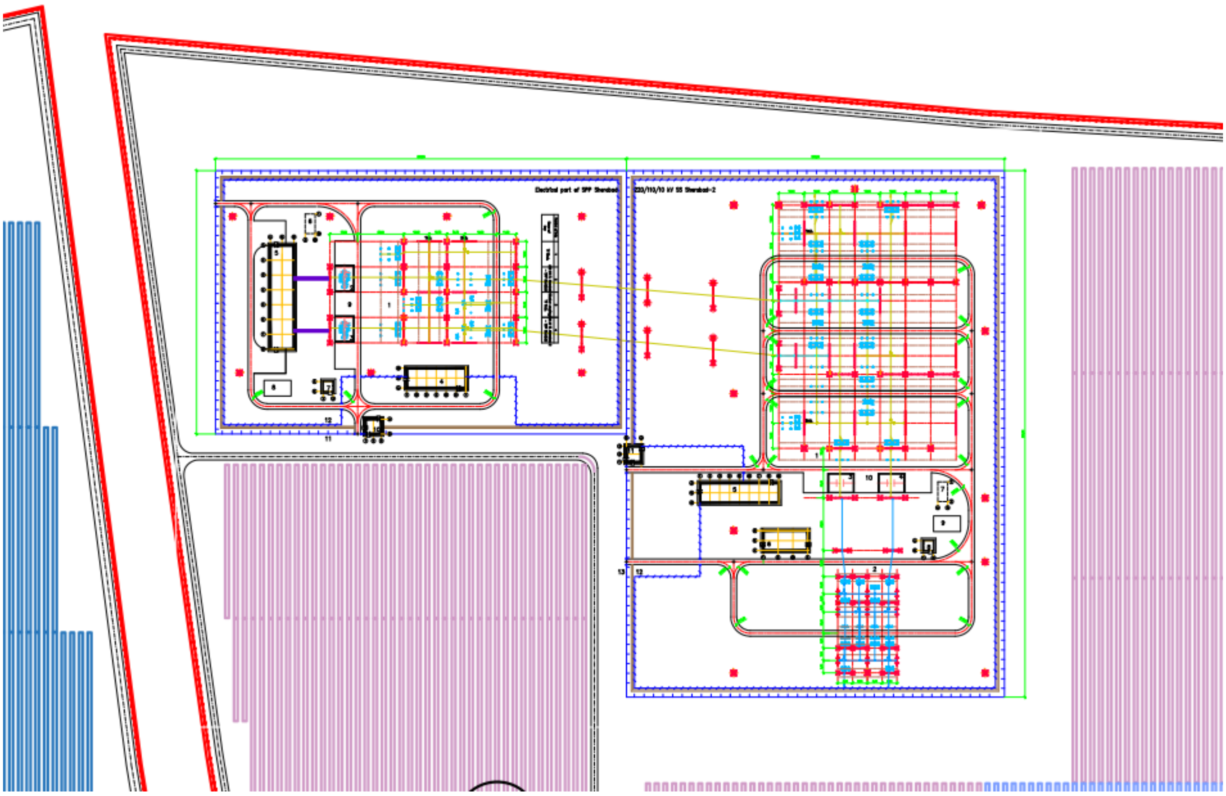

Figure 2-9. Location of on-site substation

2.3.7 Supervisory Control and Data Acquisition (SCADA) System

The plant will be equipped with a SCADA system (or monitoring system) that acquires data from the PV power plant and stores it in a database. The system typically includes data logger acquiring parameters from several components of the plant such as inverters, meters and meteorological sensors measuring temperature (ambient and on the back side of the PV modules), irradiation and wind speed. A SCADA system is a key tool for the Operation and Maintenance of the plant. Its purpose is to maximize production of energy, improve the plant's availability, and consequently allows for early detection of equipment malfunction and failure.

2.3.8 Drainage

Stormwater management and design will be needed to control run-off from the project catchment during operations to avoid erosion and sediment transport. Stormwater design will include water crossings with culverts where necessary. Internal plant stormwater management would consist of a series of standard trapezoidal ditches associated with the PV Plant sectors appropriately sized to carry storm run-off.

2.3.9 Interconnection Line

Sherabad solar PV plant is designed for a total 456.7 MWac installed power capacity. Evacuation of the energy produced shall be made to the existing Surkhan substation located 50.5km from the Project generation substation.

The transmission line generally follows the route of the existing line and crosses a number of land use types and habitats. The approximate lengths for the Overhead Line in terms of the landscape areas are as follows:

- Agro-landscape (0km at the Solar PV site to 9km).
- Shuratakum Gorge (9km to 13.3km).
- Agro-landscape (13.3km to 23.5km at Karusu River).
- Agro-landscape (23.5km to 36.2km).
- Khaudag Ridge (36.2km to 50.5km at Surkhan substation).

The transmission line route is shown in the following figures travelling in a west to east direction from the Project site.

Figure 2-10. Transmission line route from the site (agro-landscape)

Figure 2-11. Transmission line crossing area less intensively farmed (agro-landscape)

Figure 2-12. Crossing point over the Karasu River

Figure 2-13. Crossing of areas actively being farmed (agro-landscape)

Figure 2-14. Crossing of areas actively being farmed (2) (agro-landscape)

Figure 2-15. Khaudag Ridge

Figure 2-16. Khaudag Ridge (2)

Figure 2-17. Eastern side of the Khaudag Ridge

Figure 2-18. Connection point at the Surkhan substation

Interconnection infrastructures shall be the following:

- Generation substation located in the boundaries of the PV plant, including two power transformers 60/76/100 MVA, from the generation voltage level (35 kV) to the transmission voltage (220 kV) of the electrical network.
- Approximately 50.5 km 220 kV interconnection line to connect the generation substation and the transmission utility switching substation.
- Extension in two bays of the existing Samarkand switching substation in the 220 kV yard.

The conductor to be used in interconnection line shall be aluminium conductor steel reinforced AC-300 GOST 859-59. Overhead line (OHTL) shall be installed over 163 lattice type steel towers, double circuit, one cable per phase, and with two optical ground wires (OPGW) as ground wire and for telecommunications.

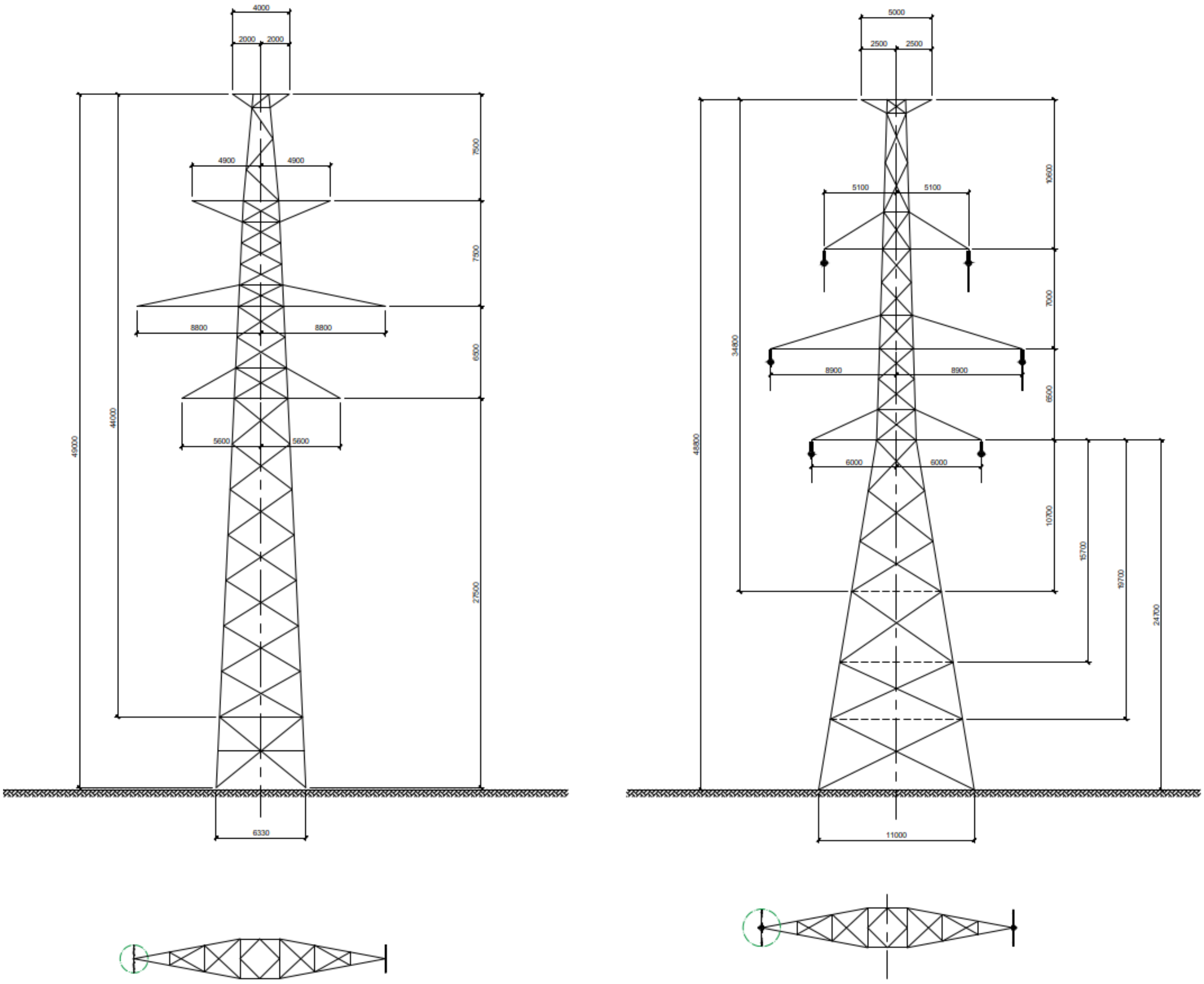

Figure 2-19. Steel lattice towers for the overhead line

Source: TYPSA, 2020b

Connection between tower and substation shall be underground with cross linked polyethylene insulated aluminium conductor armoured (XLPE) cables and dielectric cables for fibre optic (FO) communications. Depth of cable burial is 1m below ground level.

For the overhead interconnection line, double-circuit lattice towers have been selected. Types of foundations for the towers shall be as follows:

- Isolated footing.

- Pile foundations.
- Final selection of foundation type shall depend on the tower type to be installed, their mechanical stresses and characteristics and the geotechnical study of the terrain.
- The following safety and environmental aspects have been considered in the design of the transmission line:
- Avoid tracing the transmission line through protected areas, other environmentally sensitive areas or through mature forest stands.
- Avoid cultural and heritage sites.
- Place transmission line towers at high points in the terrain so that conductors can be chained over valleys, thus eliminating the need to remove trees.
- Locate the transmission line along the base of mountain slopes, rather than in the centre of valleys where heavy birds might contact conductors.
- Locate the transmission line to avoid passing through settlements and populated areas.
- Minimize the need to build new access roads whenever possible.
- Use existing roads and access roads whenever possible.
- Ensure that minimum distances between cables and the ground, highways, roads, railway lines, buildings, communication systems, etc. are compliant with GIIP (Good International Industry Practice).
- Ensure adequate right of way to each side of the transmission line for community safety and in line with GIIP.
- Ensure the appropriate design of the towers and associated components (cross arms, position of insulators etc) and installation of conductors according to best international practices for protecting birds against collision and /or electrocution. A proper design may reduce 100% electrocution and minimize collision risk.

Bird diverters will be installed on both earthing cables, on the full length of the high voltageline. The distance between diverters will be 10 m. The final choice of diverter will be based on both effectiveness together with a long-term guarantee against failure.

2.3.10 Office Building

Monitoring of the solar power facility operation will be conducted from the office building.

2.3.11 Fencing and Security

To prevent unauthorised access, the perimeter of the PV power plant will be fenced with an approximate 2.5 m high welded wire fabric fence with 0.5 m coil of razor wire mounted above. Pole mounted internal facing closed circuit television (CCTV) cameras will be installed around the perimeter of the site. Lighting of the fence shall be sufficient for the operation of the security CCTV system. A typical fence and CCTV system is normally relatively subtle against the landscape of the solar park and a typical set up is shown in Figure 2-20.

Figure 2-20. Typical Fence and CCTV System at a UK PV Facility

Source: AECOM, 2019

2.4 Construction

2.4.1 Construction Programme

The construction is planned to start in 2023 and is expected to last approximately 18 months, with first power targeted in 2024. The key stages of construction, from mobilisation of workforce to commercial operation date.

2.4.2 Construction Activities

Construction activities will comprise:

Site preparation:

- Temporary fencing of the Site
- Vegetation clearance
- Earthworks, including ground levelling (cut and fill), installation of drainage ditches, trenching for cables, construction of internal site tracks. Excavated material will be re-used within the Site for backfilling as much as possible (subject to geotechnical suitability) in order to reduce the need for aggregate to be brought to Site from elsewhere

PV power plant installation:

- Import of components to Site
- Installation of foundations and mounting structures
- Installation of solar panels
- Installation of other equipment and infrastructure (inverters, substation)
- Installation of lattice steel towers for the connection to the national grid substation
- Installation of export cables
- Connection to national grid substation

Commissioning of the PV plant:

- Mechanical and visual inspection

- Electrical and equipment testing
- Commencement of electricity supply into the grid

Site clean-up and reinstatement.

2.4.2.1 Earthworks

Soil will be stripped on areas required for roads and hardstandings, including temporary construction compounds, offices and other buildings. Outside of these areas, soils will not be stripped with the aim of reducing impacts of habitats within the site.

The excavations needed for the development of the plant will be generally carried out in loess and sandy loam deposits. Based on the exploration and the geologic setting of the Sherabad area, conventional grading and backhoe equipment will be able to excavate these deposits.

Where necessary, e.g. under roads and facilities, the ground will be compacted to prevent soil collapse.

The proposed facilities and auxiliary buildings can be supported by shallow foundations (typically spread footings or slabs) over compacted fill. Ground treatment techniques may be needed for improving soil bearing capacity for these foundations. Considering that the average thickness to be treated is around 2 m, rolling dynamic compaction (RDC) is proposed as a cost-effective solution. RDC consists of a non-circular module of 3, 4 or 5 sides, that rotates about its corners as it is towed, causing it to fall to the ground and compact it dynamically. The weight of the module is between 8 and 12 ton (TYPSA, 2020a).

Figure 2-21. Rolling dynamic compaction (RDC)

Source: TYPSA, 2020a

Fill operations will be required to create platforms for facilities and site roads. The Project will balance the cut and fill operations to maximise the use of local materials (as long as they fit the necessary geotechnical parameters).

The following areas will be cleared during the initial earthworks.

Table 5. Earthworks

Parameter	Area
Length of fence (m)	17,080
Area or roads (m2)	To be confirmed
Area of substation (m2)	48,000
Area of inverter bases and any other infrastructure or hardstandings (m^2)	1,200

Parameter	Area
Area of laydown area (m^2)	24,200
Area shaded by PV panel (m^2)	2,286,095
Area of land left free of panels (m^2)	3,903,905
Land Boundary Area (m2)	6,190,000

Source: Masdar

Based on the initial site design as set out in the table above, a total of 7.34 ha land would be cleared or just under 1.2% of the overall site area. This area currently does not include land required for internal access roads. It is estimated that there would be an additional 1% coverage by roads taking the area of habitat lost to 2.2%.

2.4.3 Workforce

Masdar confirm that the workforce during the peak construction period is 1,146 workers. During the early stages of construction, the worker numbers will be low (under 100) but will rise quickly from month 5 when the civils work begins. After the peak level has been reached, the local workforce will gradually be reduced leading up to the start of operations.

The workforce will comprise a mix of highly qualified specialists, technicians and low-skilled personnel. Low-skilled construction workers will receive job-appropriate training before starting work on the Project. This includes basic training on health, safety and environment (HSE), labour management and, where required for specific job profiles, vocational training.

Ideally, the workforce will be sourced locally, especially for the low-skilled staff. Qualified specialists will be sourced both nationally and internationally, depending on the skills availability. The EPC Contractor suggest that up to 70% of the required workforce can be sourced locally, subject to available skill levels.

2.4.4 Worker accommodation

It is considered by the EPC Contractor that there is sufficient accommodation available in the local area to accommodate the workforce. Nevertheless, given the large size of the peak workforce a dedicated workers camp may be required. The availability of accommodation will be confirmed by the EPC Contractor and if necessary, a dedicated construction camp would be provided in accordance with the IFC/EBRD Guidance on Workers Accommodation. Any additional land that may be required would be temporary and acquired on a willing buyer / willing seller basis to avoid triggering further requirements under IFC PS5.If required, accommodation facilities (including potential workers accommodation camps) to comply with the principles of the IFC/EBRD Guidance on Workers Accommodation, national law and will adhere to the following key requirements:

General living facilities

Ensuring good standards in living facilities is important in order to avoid safety hazards and to protect workers from diseases and/or illness resulting from humidity, bad/stagnant water (or lack of water), cold, spread of fungus, proliferation of insects or rodents, as well as to maintain a good level of morale. The location of the facilities is important to prevent exposure to wind, fire, flood and other natural hazards. It is also important that workers' accommodation is unaffected by the environmental or operational impacts of the worksite (for example noise, emissions or dust) but is adjacent to the work site to avoid workers spending undue amounts of time travelling from their accommodation to the worksite.

Water

Special attention to water quality and quantity is absolutely essential. To prevent dehydration, water poisoning and diseases resulting from lack of hygiene, workers will have easy access to clean water from the municipal potable water pipeline. An adequate supply of potable water will be available in the buildings where bedrooms or dormitories are provided.

Wastewater and solid waste

Wastewater treatment and effluent discharge as well as solid waste treatment and disposal will comply with local and World Bank effluent discharge standards and be adequately designed to prevent contamination of any water body, to ensure hygiene and to avoid the spread of infections and diseases, the proliferation of mosquitoes, flies, rodents, and other pest vectors. Wastewater will be collected in a septic tank and collected and disposed of at a licensed facility.

Room/dormitory facilities

The standards of the rooms or dormitory facilities are important to allow workers to rest properly and to maintain good standards of hygiene. Overcrowding should be avoided particularly. This also has an impact on workers' productivity and reduces work related accidents. It is generally acknowledged that rooms/dormitories should be kept clean and in a good condition. Exposure to noise and odour should be minimised. In addition, room/dormitory design and equipment should strive to offer workers a maximum of privacy. A separate bed for each worker will be provided. There will be a minimum space between beds of 1 metre. Dormitories and rooms will be single-sex.

Sanitary and toilet facilities

Sanitary and toilet facilities will include all of the following: toilets, urinals, washbasins and showers. Sanitary and toilet facilities will be kept in a clean and fully working condition. Facilities are likely to be of portacabin type and will be easily cleanable and ensure privacy. Separate sanitary and toilet facilities will be provided for male and female residents. Additional specific additional sanitary facilities will provided for women. Up to 70 toilets will be provided to coincide with the peak workforce of 1,000. At other times a reduced number of toilets will be provided at the ratio of 1 toilet per 15 persons.

Showers/bathrooms and other sanitary facilities

Hand wash basins and showers will be provided in each of the bedrooms. These facilities will be kept in good working condition and cleaned frequently. Adequate space will be provided for hanging, drying and airing clothes. Hand washing, shower and other sanitary facilities should be located within a reasonable distance from other facilities and from sleeping facilities in particular. Approximately 70 showers will be provided to coincide with the peak workforce of 900. At other times a reduced number of showers will be provided at the ratio of 1 shower per 15 persons.

Canteen, cooking and laundry facilities

Good standards of hygiene in canteen/dining halls and cooking facilities are crucial. A centralised kitchen will prepare all food for distribution to individual dining areas. Laundry facilities will also be provided.

Medical facilities

Access to adequate medical facilities is important to maintain workers' health and to provide adequate responses in case of health emergency situations. It is assessed that the local medical facilities could become overwhelmed should there be a significant number of workers requiring treatment. It is proposed that there will be one doctor on site during normal working hours, one doctor on call, and two nurses. In addition, it is proposed to have 1 first aider per 25 workers. This will require a total of 40 first aiders at the peak workforce.

2.4.4.1 Supply Chain

Masdar conducts in-depth due diligence on every entity that it works with and ensures that suppliers and contractors adhere to Mubadala's Code of Ethics and Business Code of Conduct. In addition to including the necessary contractual protections/covenants in the EPC contract and supply agreements, Masdar also has a supply chain management system that includes the relevant policies (e.g., a sourcing policy, a supplier code of conduct), responsibilities, practices, monitoring procedures and resources for developing, implementing, achieving, reviewing and maintaining compliance with the Labor Standards on Forced Labor and identifying, assessing and managing on an ongoing basis the Project's risks in the supply chain of Solar Power Products relating to Forced Labor Matters and arising in relation to Masdar and the Supply Chain Stakeholders (the EPC Contractors, the Solar Supplier(s) and the Approved Solar PV Module Manufacturer(s)).

2.4.5 Water and Energy Requirement

During construction, water will be needed in the construction camps for:

- domestic purposes by workers (drinking, washing hands, flushing toilets)
- construction activities (wash down of equipment and vehicles)
- dust suppression on community roads and on the site roads
- concrete mixing

Masdar estimate the amount of water required during construction at 35,834 m^3. The source of water required for construction has not yet been determined. The EPC Contractor is consulting with the water authority.

2.4.6 Site Access

For heavy equipment and vehicles to access the site, it is possible that some existing roads and bridges will need to be widened/reinforced to accommodate wider loads.

2.4.7 Construction Vehicles and Equipment

Construction of the solar facility will require various types of machinery and equipment. Exact plant types and numbers will be determined during the detailed design stage. However, for the purposes of this impact assessment an indicative equipment list is as follows:

- Backhoe
- Pick–up
- Excavator
- Ramming machine
- Cable pulling machine
- Telehandler
- Dumper

The construction phase is expected to generate the traffic volumes detailed in Table 6.

This estimate is limited to the expected amount of HGV movements and construction staff transportation requirements. The HGV movements estimated peak is expected to last one month and to be 1,460 vehicles during this month. It is also likely that a larger bus would be provided for construction workers thereby reducing the number of vehicle movements. It is also considered that a large proportion of the staff will be accommodated at the workers camp, in the proximity of the project site. However detailed traffic types and volumes have not yet been provided. This will be provided by the EPC contractor as part of detailed design.

Table 6. Estimated Construction Traffic

Vehicle Type	Activity	Total Vehicle Movements
HGV	Delivery of materials, plant, containers, concrete, aggregate material and welfare facilities	12,060
LGV (people carrier up to 6 people)	Transportation for construction workers to site	2,800

There is likely to be a requirement to transport abnormal loads to the site, for example some of the substation equipment may require an abnormal sized or weight vehicle. The delivery of these abnormal loads will be infrequent and timed so as to avoid network peaks and therefore have not been considered as part of this assessment. The transport of abnormal loads will be co-ordinated with the relevant local police authorities in order to mitigate their impact on other road users. This will be included in the Traffic Management Plan.

2.4.8 Waste Management

The majority of waste will be generated during Project construction, originating from packaging materials (wooden pellets and cartons), which can be recycling or reused. There will also be some minor waste arisings from the kitchens and offices associated with the workforce on site. Solid waste materials generated by the Project during construction will be segregated and stored on-site prior to transport to licensed landfills. It is noted that currently no recycling facilities are available however waste will continue to be segregated. The EPC Contractor will confirm the final arrangements as part of their detailed design.

Wastewater and sewage will be temporarily stored onsite and then hauled to an appropriately licensed wastewater treatment facility. The Project will not construct or operate its own wastewater treatment, landfill, or recycling facilities. Tankers would be deployed to carry the waste generated to the nearest treatment facility.

Only licensed waste management companies will be used by the Project and will be subject to appropriate due diligence checks prior to contracting.

Estimated waste arisings are based on previous experience in Uzbekistan and are summarised in Table 7.

Table 7. Estimated Project Waste Arisings during Construction

Waste stream	Estimated quantity
Hazardous waste	
Solvent waste	2 l
Used and spent oils	200 l
Hydraulic fluid	40 l
Resins and paints	10 l
Waterproofing compounds	20 l
Adhesives	4 l
Machinery lubricants	40 l
Waste chemicals - used in the concrete forming process	20 l
Clean-up materials (such as spill kit wastes and rags) contaminated with the items listed above	1 m^3
Drums, containers and tins with remains of hazardous substance	4 m^3
Non-hazardous solid waste	
Soil	TBC
Concrete	4 m^3
Asphalt paving	2 m^3
Scrap steel	10 t
Glass	TBC
Plastics	10 m^3
Packaging materials	20 m^3

Wood	10 m^3
Sewage and grey water	TBC

2.5 Operation

Masdar will be responsible for the design, build, finance, operate, maintain and transfer (DBFOMT) of a solar PV power plant. During the operational phase, JSC National Electric Grid of Uzbekistan will purchase the generated electricity as per the Power Purchase Agreement (PPA).

After commissioning, the transmission line will be transferred to JSC National Electric Grid of Uzbekistan for operations and maintenance. JSC National Electric Grid of Uzbekistan will be responsible for the maintenance of the safety protection zone under the transmission line including vegetation management and land use close to the line.

2.5.1 Routine Maintenance Activities

Operation and maintenance of the facility will include:

- Replacement of faulty PV modules
- Repair of inverters and other ancillary equipment
- Periodic cleaning of PV modules depending on soiling and sand/silt accumulation
- Delivery of water and emptying the septic tank
- General upkeep of the territory within the Solar PV Site

A preventive maintenance program will be established for maintenance of the inverters; mounting structures; surge arresters, cables and PV junction boxes; meteorological station; security, fencing and gates; ditches and drainage culverts; and all sub-station components, including services and septic tank.

2.5.2 Workforce

The operation of a solar PV facility requires a small team of people. The number of operational workers will depend on the final operation and maintenance concept but is expected to be up to 25 people required for continuous presence onsite. Additional specialists will be required to attend the facility to conduct repairs and maintenance of the equipment.

2.5.3 Water and Energy Requirements

It is estimated that 2,500 m^3/year of water will be required to wash the PV panels (two wet cleanings per year). Cleaning schedule optimization can minimise the annual volume of water used for panel cleaning and dry-cleaning methods can also be used if water quality and quantity warrants such methods. Cleaning strategy will be defined in the operations and maintenance contract, but it is expected that a cleaning technology that minimise water consumption as much as possible is implemented.

2.5.4 Waste Management

Solar PV electricity generation produce little waste in itself. Minimal waste will be generated during Project operation, associated with the main control room / amenity building activities, maintenance and repair work. There will be a toilet facility and kitchen onsite during operation; the sewage and grey waste water will be routed to a septic tank which will be emptied on a regular basis. Solid waste materials will be segregated and stored on-site prior to transport to landfill. Currently no recycling facilities are available.

Estimated waste arisings for the operational phase are summarised in Table 8.

Table 8. Estimated Project Waste Arisings during Operation

Waste stream	Estimated quantity	Management
Hazardous waste e.g. faulty PV panels, batteries, lights, paints, solvents and chemicals, spill response equipment	None / negligible	Collected on site in specialised containers. Removed by an appropriately licenced third-party waste management company.
Non-hazardous solid waste e.g. general (domestic) waste, kitchen waste, plastic, cardboard, paper, glass, scrap metal, wood	200–300 kg per year	Segregated collection on site. Removed and transported to licenced third-party waste and recycling management facilities.
Sewage and grey water	0.02 m^3 / day	Collected on site and transported to a treatment facility.

2.6 Decommissioning

A typical design life of a solar PV facility is 20–30 years. The Project components will be continuously maintained throughout the lifetime of the Project. The condition of equipment will be reviewed at the end of the design life to determine whether it remains in a viable condition to continue operation after that time. The facilities may be upgraded or renewed based on the cost-benefit analysis.

The Project will be dismantled once it is no longer economical, and the land plot reinstated to its current state (albeit not reprofiled). Decommissioning of the PV power plant is expected to require 6–8 months to complete.

During decommissioning, all above ground infrastructure will be removed. It is anticipated that the redundant solar PV panels will be either recycled or sold for reuse, depending on market conditions at the time.

Below ground infrastructure such as buried cables will be removed to a depth of 0.5 m and backfilled with topsoil.

The site will be re-seeded with plants consistent with surrounding areas. The success of bio-restoration will be monitored for two dry seasons following decommissioning, and remedial actions will be taken at locations where rates of restoration are below the expected levels.

The decommissioning will abide by the relevant legislation and regulations that are applicable at the time and decommissioning will be planned at least six months in advance.

2.7 Alternatives

2.7.1 No Project Alternative

The first alternative considered for any new project is a no development option, which means not adding a low carbon (solar) generation capacity into the country's energy mix. Uzbekistan has vast natural gas reserves, and over 85% of electricity here is being produced from natural gas (International Energy Agency, 2020).

Presidential Decree No. PP-4477 of 4 October 2019 approved the Strategy for the Transition of the Republic of Uzbekistan to the Green Economy for the Period 2019–2030 (The President of the Republic of Uzbekistan, 2019). Priority goals of the Strategy include reducing specific GHG emissions per unit of GDP by 10% of the 2010 level and raising the share of the renewable energy sources in total electricity generation to more than 25% by 2030.

With the projected growing electricity demand, increasing the share of low-carbon energy generation, like solar, in the national energy mix is vital for carbon emissions reduction and mitigation of global climate change. Owing to its geographical location and climate Uzbekistan has significant solar potential. In case of a no development option, the opportunity to contribute to the achievement of the Strategy goals will be missed.

2.7.2 Site Selection

In identifying a suitable site for solar energy developments, various elements were considered by Suntrace. These included:

Site Suitability Infrastructure/Interconnection Environmental Impact Social Impact With these criteria in mind, the Government of the Republic of Uzbekistan identified several potential sites for the utility scale solar PV facilities throughout the country, including Surkhandarya region.

2.7.2.1 Overview

Suntrace carried out a site selection exercise with three potential sites. Suntrace were provided with an old feasibility study (Ref FS-2014). Based on the technical due diligence of the site presented in FS (the project site), no red flags were identified regarding the development of a PV power plant in terms of land characteristics, environmental issues, and social criteria. The original feasibility study was not available for review.

However, Suntrace identified that the majority of the surrounding high voltage substations had no capacity to evacuate the energy produced in a utility scale PV power plant. Only two substations have sufficient capacity: Sherabad Substation -located 70km away, and Surkhan Substation located 46km away from the project site.

The interconnection between the FS 2014 original site and the substation require a new overhead transmission line (OHTL). To minimize the impact on the project in terms of investment, time delivery and legal as well as the environmental and social aspects, additional sites were reviewed as an alternative to the FS original site.

Two extra sites were analysed in addition to the site proposed in the FS 2014. In total, three site visits were conducted.

It should be noted that the preferred site was presented to potential bidders by the Government of Uzbekistan and as a result there was no opportunity for Masdar (the Developer) to influence site selection.

The following site selection study has been reproduced from the Suntrace Feasibility Study Report (2020).

2.7.2.2 Original site (Sherabad Solar Site FS-2014)

The site is approximately 620ha and can easily accommodate PV plant of 200MWac capacity. However, grid connection can become an obstacle. Adverse environment impacts associated with the project can be avoided or minimized through careful site selection for the solar plant and route selection of the transmission line. It is estimated to be Category B (no major impact) from E&S perspective.

In short, the site appears wasteland and very suitable for a solar PV plant. No major impact from social or environmental perspective. The only point of concern is the grid connection. There is no substation in proximity of the site. Constructing a new line will increase the CAPEX of the project but can also be a strategic investment.

Figure 22. Original site

2.7.2.3 Kumkurgan (near Sherabad substation)

One of the main advantages of this site is the proximity to the Sherabad Substation (5km). No problems concerning the grid connection expected. However, the substation is surrounded by undulant terrain, consisting out of plateau-type hills, intersected by rainwater-streams. The area marked in red in Figure 2-1 shows a rough indication of the potential shape for a hilltop located solar PV plant. The area covers 11ha merely, which is sufficient for 5-10MW of PV. Clearly, installing 200MW on this hilltop would be a diligent and complicated exercise to adjust to the topography.

Besides, the access to the site was through a dirt road along the canal, and then through a farmer's private property, passing over a small and weak bridge to reach the hilltop. This access was immediately commented by the social expert as not suitable. The reservoir located North of Kumkurgan is listed as an Important Bird Area (IBA). The IBA is approx. 8 km distance to the alternative proposed site, and this would very likely require a detailed assessment of the migratory birds fly paths.

In short, although this site solves the grid connection problem, it offers substantial obstacles from environmental, social and site topography perspective.

Figure 23. Kumkurgan site

2.7.2.4 Potential site (Near Surkhan substation)

There was no option of reaching the selected area by car for the site visit team. The dirt road was not passable. There are existing transmission lines visible from the site. The site looks big enough to accommodate 200MW. However, from the preliminary analysis, the bird protection area is close to the site and the area of influence passes almost over the site. Water availability is not clear.

In summary, use of the site as alternative negatively impacts the final cost of the PV power plant as it will require a new access road, water pumping station and sandstorm protection.

Figure 24. Surkhan site

2.7.2.5 Summary from Suntrace study

Table 9. Site selection summary

Criteria	Original site (Sherabad solar site FS 14)	Alternative site (Kurkumgan Solar site)	Potential site (Near Surkhan substation)
Site Suitability	Perfect for PV, proximity to main road, almost flat topology, 620ha sufficient for >200MW PV plant. The surrounding area is considered acceptable for potential new developments.	No large shape land area available, only scattered lots along hilltops, poor access road, hilly terrain with evidence of soil erosion. Impossible to construct 200MW in a connected area.	No infrastructure to the site, weak consistency of the sandy soil surface, presence of dunes, no water available for cleaning, prone to sand- or dust storms. Size of area sufficient for 200MW.
Infrastructure/ Interconnection	Need to construct 50 km of Transmission line.	Need to construct 5-6 km of transmission line.	Need to construct 14km of transmission line. In addition, new access road and water pump station needs to be built (approximately 4km of new road).
Environmental Impact	No significant impact for the site itself. Adverse impact can be avoided/minimized by careful TL route selection. Bird flyway/migration to be checked to-wards river at Afghan border.	Important Bird Area (IBA) is located at Kumkurgan reservoir 8km from the site. Detailed assessment required to check bird migration flyways.	Less data available. The bird protection area is close to the site. Might require detailed assessment.
Social Impact	No major impact regarding the site, need to exclude cemetery from PV plant area. Adverse impact can be avoided/minimized by careful TL route selection.	No major impact on site. The access used for the site visit is not suitable, an alternative access must be determined.	No information available
Financial	Construction of TL estimated approx. 10M USD (direct line between PV plant and Surkhan sub-station).	Access road from hillside required, scattered PV arrangement does not allow clear array arrangement. Cost impact not evaluated.	Construction of TL, new access road, water supply from 10km distance (total cost estimated at 4mUSD for TL and 9mUSD for access road.
Conclusion	This site is considered the most suitable. A careful selection of the TL route is required, and depending on the E&S findings the safeguard category can be defined. TL cost and risk allocation can be resolved and does not impose a technical constraint. Recommended to select this site for detailed analysis.	The area is not deemed suitable for a 200MW size plant, and additionally the IBA in close distance will require a detailed bird migration survey.	The site could not be accessed during the site visit due to sandy soil conditions. A new access road would be required for at least 4km length. This is offsetting the savings in TL distance. Soil conditions are expected to be not suitable

Source: Suntrace Feasibility Report[1]

[1] Suntrace, 2020. Uzbekistan Sherabad Solar IPP Project Feasibility Study Report for Utility-Scale Solar Photovoltaic PPP Project in Sherabad District, Surkhandarya Region of the Republic of Uzbekistan

2.7.2.6 AECOM Review of Site Selection Process

AECOM has undertaken a further review of the PV site and OHTL route to determine whether the site is considered suitable from a technical, environmental and social perspective. In identifying the suitability of the site for solar energy development, AECOM reviewed the following factors:

- Solar resource
- Environmental designations
- Residential properties
- Site access
- Grid connection

AECOM provided further updates on land use and biodiversity following site visit to determine if there are further issues that could affect the viability of the project. Finally, the review of site suitability considered EBRD PR6 requirements triggered by impacts to Critical Habitats and/or PBFs (EBRD PS6, para 13 and 16).

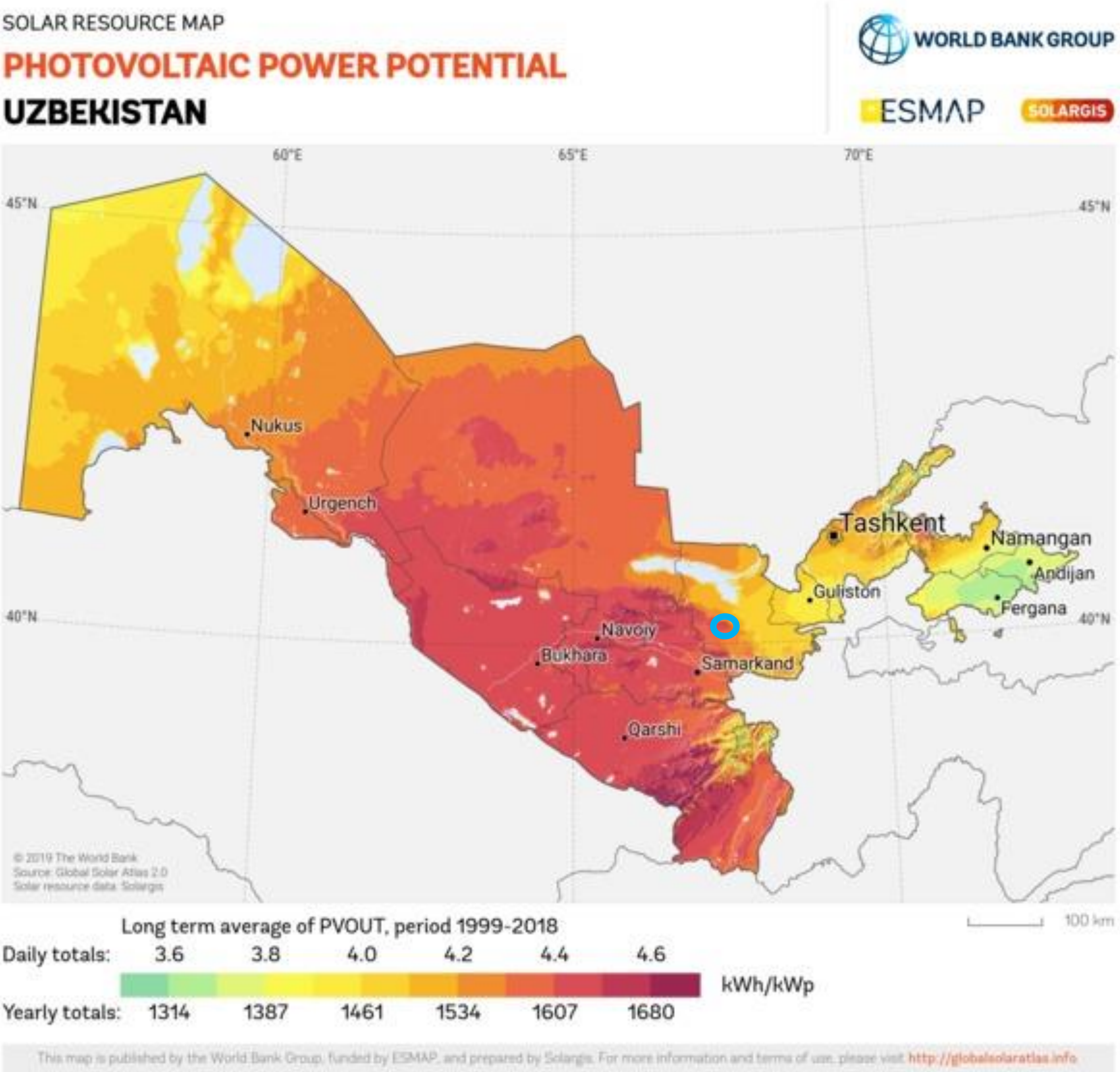

Figure 25. Solar resource map (site shown in blue)

Table 10. Summary of site selection criteria

Criteria	Overview	Likelihood of significant impact[2]
Solar resource	As can be seen on Figure 15 the potential project site is situated in an area of high solar resource. This would confirm that the project site is located in a suitable location in terms of likely energy yield.	No issues identified
Environmental designations	Overall, five KBAs occur within 50km of the Project Site as follows: • The Kugitang and Baysuntay Mountains KBA - >40km from the Project Site at its closest point; • The Amudarya flood-lands KBA - >10km from the Project Site at its closest point; • The Koyendag KBA occurs within Türkmenistan and overlaps the Kugitang State Nature Reserve; • Aktepe reservoir - >10km from the Project Site at its closest point; and • Yuzhno Surkhan reservoir ->45km from the Project Site at its closest point. The project AOI does not intersect any of these protected areas / KBAs. These protected areas are associated with either mountainous terrain or wetlands, and therefore support ecosystems that differ substantially from ecosystems within the study area. These protected areas are therefore not expected to be influenced by the proposed development and are not considered critical habitat features associated with the project. .	Project is not expected to impact on designated sites.
Residential properties	There is a small group of properties located around the brickworks on the southern edge of the site. In addition a seasonal dwelling and fishponds were noted immediately outside the site boundary. The boundary has been set to avoid physical resettlement. The closest properties appear to be approximately 150m from the red line boundary. The project activities can be scheduled to take place during less sensitive time (travel to and from schools for example). No night work is permitted.	Nuisance impacts expected to be minimal and mitigation can be applied.
Site access	Access route selection is still being undertaken for the project. Options are screened on an initial 200m buffer to minimise noise and community H&S impacts. Where no suitable buffers exist, AECOM and Masdar identify those with least impacts that are still technically viable. The access track will be identified that minimises the impact on the surrounding residential properties.	Access route can be optimised to minimise impacts.
Grid connection	It is noted that the key transmission and distribution infrastructure is aging because the network was developed during the Soviet era as part of the regional grid in Central Asia. Some of the transmission and distribution lines, substations, and auxiliary facilities built during the Soviet era have become obsolete and past their economic life. For this reason, the electricity losses are high, estimated at 20 percent of net generation. To address this issue, a number of improvement projects have been implemented across Uzbekistan. There is a need to be close to the existing or planned HV grid to minimise electrical losses in transportation on the Project's connection and then also in the wider network. The project OHTL would meet those objectives and is close to the main demand centres of Sherabad and Termez.	Most direct grid connection route has been chosen. Land use impacts would be minimised.

[2] In this case 'significant' would refer to impacts that cannot be mitigated by standard means or would materially affect the viability of the project.

	At the bidding stage, Masdar were provided with an RFP from the GoU which included technical specifications for the grid connection. As a result, the grid connection has been designed in accordance with the off-taker's requirements. This has been contractually agreed as an OHTL with specifications as per the GOST standards. To confirm, the design of the OHTL is in compliance with the requirements of the off-taker and the locally enforced GOST standards. Masdar were restricted by the off-taker design requirements which prevented the design of underground cable. A deviation from the GOST standards would not be permissible. It is estimated that the underground option can be 2-5 times more expensive than an overhead line due to the difficult terrains and hard ground strata, thereby resulting in a significant commercial impact that cannot be absorbed making the project economically unviable. The exact costs cannot be determined with ground investigation to determine the underlying strata and required construction techniques. It is important to note that this project has been procured at a very competitive energy tariff level that is unprecedented in Central Asia, with the main aim of providing cheap electricity to the Republic of Uzbekistan and help in further accelerating the energy transition and meetings the increasing energy requirements during this period of rapid growth and development. The ~50 km connection is deemed to be the preferred option in terms of land use. Land use impacts are discussed in more detail below. The project recognises that an OHTL introduces biodiversity impacts that have been mitigated or offset. Again, these have been discussed below. Given the fixed location of the PV site, the OHTL is assessed to have minimised potential impacts. The route is the shortest feasible route between the solar PV site and the substation and follows an existing OHTL corridor. Any alternative overhead route would increase the length of the transmission line and increase the potential avian collision risk. In accordance with EBRD PR 6, Para 13. it is not considered that there are any economically feasible alternatives that would avoid or materially lessen the impact on PBFs and CH qualifying species.	
Land Use	A review of aerial mapping shows that the site has been used for cultivation. It is understood that no arable farming now takes place on the site. There are more intensively farmed areas visible surrounding the site area. There appears to be more natural habitat to the north and northeast of the site towards the mountain range. There is no clear linkage between that area and the PV site. The installation of towers would require a significantly lower amount of land take compared to underground cabling.	Land does not appear to support agriculture so limited economic activity reliant on the land. No issues predicted.

Additional review of site suitability following the ESIA

Land Use (additional)	Following site visits, AECOM confirm that the land is no longer used for cultivation. There was evidence of past cultivation dating back to Soviet times but the land is poor quality with increased salinity. Affected people adjacent to the project site is restricted to those using the land for grazing but the PV site is generally used for access. The land surrounding the project is intensively farmed and land use is considered typical for the region. The project has mitigated impacts through the LRP. An OHTL would result in a discreet number of tower bases that would create disturbance and some loss of agricultural land that has been covered under	Confirmed that project land is not productive and alternative land is available for grazing. OHTL route minimises impacts on farmland.

	the LRP. An estimate of 20,375m^2 of land take would be required for the 163 tower bases but exact land take varies per base depending on slope and terrain. Actual land take varies between 40 and 210m^2 per base. An underground grid connection would result in significantly higher additional impacts on livelihoods due to the greater level of disturbance and limitations on agricultural activity during operation along the whole length of transmission line. It is estimated that approximately 3,030,000m^2 of land would be required for a 60m working corridor and would have to be compensated for, albeit a significant proportion would be for temporary disturbance. The land allocation has been agreed for the footprint of towers only. The recently issued Presidential Decree provides for the allocation of land plots for the tower footprint only. It is not therefore possible to increase the land allocation at this stage without a complete renegotiation and would require significant time extensions which would not be able to be accommodated within the project construction schedule. AECOM confirm that this restriction was clearly made by the Ministry during negotiation of land allocation. All social aspects have assessed in accordance with tower footprints. OHTL design approvals are in the final stages with the off-taker so cannot be changed without renegotiating a new contract with GoU and the offtaker. Again, this would require significant time extensions which would not be able to be accommodated within the project construction schedule	
Biodiversity	Tajikistan Toadhead Agama (IUCN EN) is present within the Project EAAA and whilst it has not been recorded in the Solar PV Site, habitats along the Khaudag Ridge section of the Overhead Line are considered suitable with up to 30 individuals recorded in the same adjacent habitat. This is the only CH qualifying species and the Project will commit to achieving net gain over the lifespan of the project. The solar PV site and OHTL route where it crosses farmland are not considered to be suitable for this species. The ~10km section of OHTL where is crosses the Khaudag Ridge is considered suitable for the species. The biggest risk to Tajikistan Toadhead Agama would be disturbance and mortality as a result of construction works, particularly the initial stripping of soils and excavations. The Khuadag Ridge section would contain approximately 16 towers with a land take of 2,000m^2. An underground line would require approximately 600,000m^2 of land take for a 60m working width. Given that impacts would be most significant during construction, the underground option would have a significantly higher impact and is the least preferred option. Each OHTL base will be surveyed prior to work commencing and mitigation implemented. Complete avoidance of the EAAA would require an additional 30km of OHTL which would be economically unviable. The OHTL would increase the collision risk for avifauna particularly larger species on migration. This would be mitigated on the OHTL by Firefly brand bird flight diverters. It is noted that the OHTL runs perpendicular to the route of migration therefore it is considered that any alteration of the OHTL route north or south would not change the collision risk. As noted above, any alternative OHTL route would increase the length of the transmission line and increase the potential avian collision risk. Therefore, from a biodiversity perspective, having the shortest viable length of OHTL would be the preferred option to minimise collision risk.	Tajikistan Toadhead Agama is present within the Project EAAA but not recorded in the Solar PV Site. Habitats along the Khaudag Ridge section of the Overhead Line are considered suitable. An overhead line would have a significantly lower risk on this species compared with an underground cable. Specific measures will be put in place to reduce potential construction impacts for Tajikistan Toadhead Agama.

In accordance with ADB SR1 and EBRD PR 6, Para 16, the project's mitigation strategy will be described in a Biodiversity Action Plan.

2.7.3 Transmission Route Selection

Juru Energy were commissioned by Masdar to undertake a route survey to analyse the feasible options and of double-circuit overhead line on U/P 330-2 towers with split phase 2xAC-400/51 conductor from the 220 kV outdoor switchgear of 500 kV Surkhan substation to 220/110/10 kV Sherabad-2 substation with length of approximately 50.5 km.

The objectives of the route survey were to:

- Identify potentially feasible corridors (minimum of 4 in addition to the proposed route by Suntrace) based on a preliminary 'desktop study' and purchased data.
- Filter identified options against risks associated with populated areas, environmentally protected zones (Masdar E & S consultant) etc. Propose the option which fulfils the environmental and social criteria and is most technically favourable solution (in terms of construction, materials etc.).

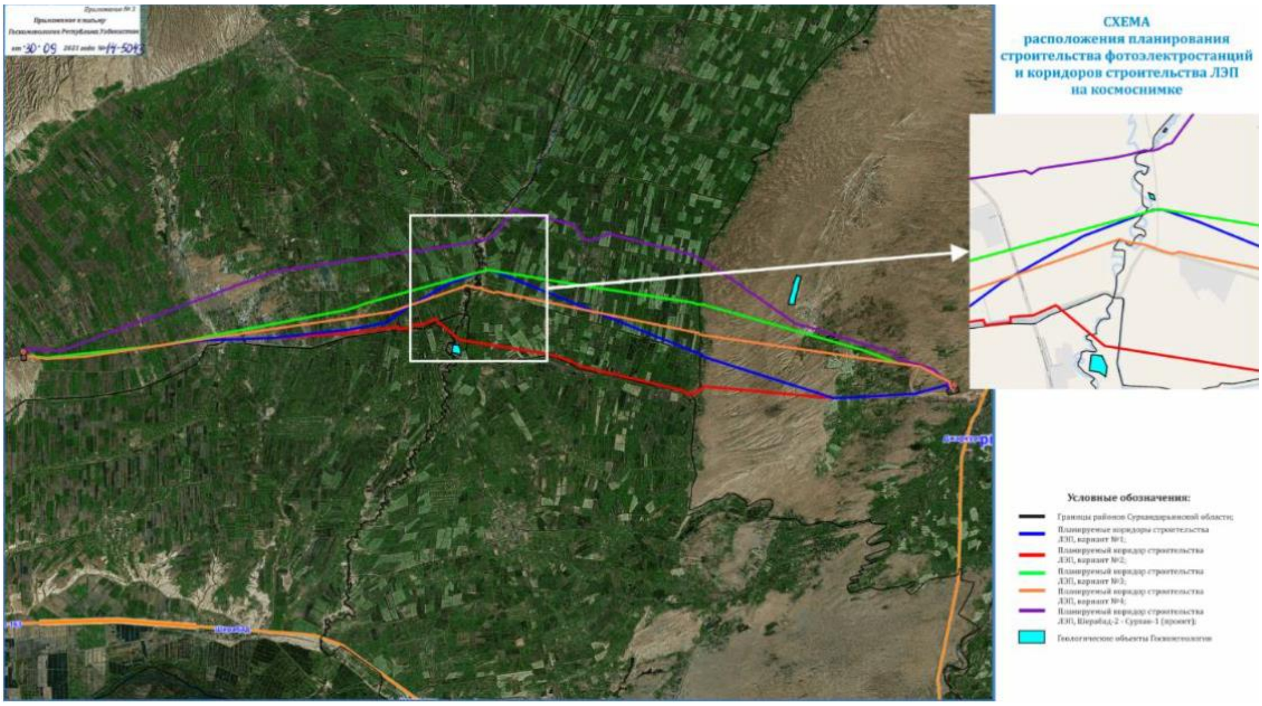

Figure 2-26. OHTL route options

2.7.3.1 Data collection

At this stage, a desktop data collection and review will be carried out in order to assess and identify preliminary feasible options and their associated risks.

Juru Energy gathered the following data:

- Available documents, reports, studies of the involved networks. Single line diagrams of connected substations.
- Information about cadastral registration (private lands, national lands and etc.) of the tower land plots of the line servitude from relevant municipalities. Available information of Uzbekistan's national design standard applicable to OHTL design, also local standard for OHTL protection (buffer) zones.
- Google Earth Pro imagery will be used.

- Obtain information from Ministry for Development of Information Technologies and Communications information about existing telecommunication infrastructures around considered routing areas.
- Obtain from State Committee for Geology and Mineral Resources information about the soil type, groundwater level, current mining works around considered routing areas.
- Data on current configuration of all the existing power lines from NEGU for considered routing area.
- Obtain from JSC "Uztransgas" information about current gas pipelines and other information around considered routing areas.

2.7.3.2 Analysis and selection of the feasible corridor

A desktop study was carried out to identify two viable options for overhead line transmission line corridors. The options were then subjected to multi-criteria analysis, including technical, environmental and social requirements.

The final best option route was determined by using the following, but not limited to, criteria:

- Provide shortest distance between source sub-station and receiving-end substation.
- Avoid hilly area, natural area & protected zone.
- Route is proposed with minimum crossings (Transmission line, Railway, Highway and River).
- Route is proposed with the least E&S impact (in consultation with AECOM).
- Least feasible/minimum cost.
- Easiest OHTL approach to the new and existing 220kV substation.
- Avoid residential areas.
- Existing facility (Pipeline, Overhead Line and Highway is crossed at 60-90 degree.
- Avoid sharp 90-degree angle at any point of intersection (PI point).

2.7.3.3 Conclusion

The proposed route-1 marked in blue and route-2 marked in red have been discounted, since both have the worst conditions. They run in a narrow corridor between the existing high-voltage lines near SS Surkhan. Furthermore, the route has intersections both with residential buildings, and with various communications.

Based on the desktop study, Juru Energy determined that two of the routes, route 3 and 4 present virtually identical passability and shorter length compared to other routes. Furthermore, during the Google Earth Pro investigation, it was identified that the routes-3 and 4 do not cross residential areas and have less points of intersection.

In general the routes run parallel to each other, cross the same areas of sensitivity and therefore present identical risks.

Table 11. Comparison between the most feasible routes

Item			
Name of Line	Route by Suntrace	Route-3	Route-4
Color of line	Pink	Green	White
Length of Total Line	50.4 km	47.5 km	47.15 km
No. of PI Point	40	24	24
Number of Transmission Line Crossings	10	15	15
Number of Communication line	2	2	2
Number of Railway Crossing	0	0	1

Item			
Number of Pipeline Crossing	1	2	2
Number of Highway Crossing	1	1	1
Number small road crossing	11	7	7
Number of Canal/Irrigation ditch crossing	61	64	59

Source: Juru Energy

3. Legal and Policy Framework

3.1 Uzbekistan's Green Economy Strategy

Uzbekistan's strategy for transition to a green economy in the period of 2019-2030 was approved by the Resolution of the President of the Republic of Uzbekistan dated 04.10.2019 No. PP-4477 (the "Resolution"). This Resolution was adopted to ensure fulfilment of obligations under the Paris Agreement on climate change signed by Uzbekistan on April 19, 2017, as well as the implementation of the Action Strategy for five priority areas of development of the Republic of Uzbekistan in 2017-2021.

The Resolution declares that the Strategy should bring the following results by 2030:

- Reduction of emissions of greenhouse gas per unit of GDP by 10 per cent of the 2010 level;
- Twofold increase of energy efficiency indicators and a decrease in the carbon intensity of GDP;
- Further development of renewable energy sources, with coverage of more than 25 per cent of the total volume of electricity generation;
- Increase of the energy efficiency of industrial enterprises by at least 20 per cent;
- Development of electrical vehicles;
- Introduction of drip irrigation technology into an area up to 1M hectares and increasing the crops yield cultivated on them by 20-40 per cent;
- Achieving a neutral balance in the degradation of land; and
- Increasing the average productivity of the production of the main types of agricultural food products by 20-25 per cent.

In addition, the Resolution identifies the priority areas in Uzbekistan's strategy for transition to a green economy:

- Improvement of energy efficiency in the basic sectors of the economy;
- Diversification of energy consumption and development of the use of renewable energy sources;
- Adaptation and mitigation of the effects of climate change, increase in the efficiency of natural resources and preservation of natural ecosystems;
- Development of financial and non-financial support mechanisms for the green economy.

Priority areas envisage the implementation of measures in various sectors of economy, including electricity, heat, oil and gas, renewable energy, construction, transportation and many more.

3.2 Institutional Framework

The Constitution and legislative norms and rules of the Republic of Uzbekistan determine the legislative, state and executive authority's environmental and social responsibilities, and also the responsibilities of private developers. The Preamble of the Constitution recognises the "priority of the generally accepted norms of the international law".[3] It is therefore considered that international conventions and ratifications will prevail over national legislation whenever the former are more stringent.

The Supreme Executive body responsible for nature protection in the Uzbekistan is the State Committee for Nature Protection (SCNP), subordinated and accountable to Oliy Majlis (Parliament). It defines state policy, takes legislative acts, coordinates and manages the activity of ministries and agencies regarding E&S issues. The Cabinet of Ministers is the Executive body responsible for the implementation of state nature protection policy, coordinate development and realization of state programs of socio-economic development. The Cabinet controls their execution and is responsible for registration and evaluation of nature resources. Obligations of regions regarding environmental protection are put to the Soviets of National Deputies, headed by the Leader of administration (khokims). Regional and local government

[3] Constitution of the Republic of Uzbekistan http://constitution.uz/en/clause/index (20/02/2020)

are responsible for registering and evaluating the condition of nature resources, ecologically harmful facilities and are responsible for control, nature protection and usage of nature resources.

Execution of nature protective measures, control function and responsibility regarding nature protection rests on a number of ministries and agencies. Responsibilities of these bodies include provision of stable system of state service, development and realization of specialized programs, strategies and plans of actions and sustainable nature management. Regional departments and agencies are generally lower executive bodies of the SCNP and other responsible ministries on regional and district levels. Organizations at the regional level have the same structure as the republican level.

Public meetings (makhalla) are an independent mechanism of self-government, which carries out general initiatives and measures, including those connected with ecology, directly in villages, regions, districts and cities. See more information on makhallas below in Section 3.4.

3.3 National Environmental and Social Legislation

3.3.1 Overview

Within the limits of established state policy under the direction of the President and Cabinet of Ministers (CM) in the Uzbekistan, attention is paid to the execution of accepted ecological obligations. Nature conservation policy of Uzbekistan and implemented measures related to environmental protection and nature management are based on the following principles:

Integration of economic and ecological policy for conservation and rehabilitation of the environment as a necessary condition for increasing the population's standard of living;

Transition from protection of some individual environmental elements to a more general and complex protection of ecosystems;

Placing a responsibility on all members of society for environmental protection, conservation of biodiversity and improvement of the conditions of the general population.

National environmental legislation is based on the regulations of the Constitution of Uzbekistan, which was accepted on December 8, 1992, amended in accordance with the Law of Uzbekistan dated 28.12.1993, No. 989-XII, and the Law of Uzbekistan dated 24.04.2003 No. 470-II. There is a requirement that Government, departments, public officers, social associations, and citizens act in accordance with the relevant Constitution and laws. (Article 15). None of the regulations of Constitution can be interpreted to the prejudice of rights and interests of Uzbekistan. None of the laws or other normative-legal acts can contradict norms and principles of the Constitution (Article 16).

In accordance with the Constitution of Uzbekistan, land, its resources, flora and fauna, and other natural resources are national wealth and are subjected to rational usage and protected by government. Article 55 of the Constitution of the Uzbekistan states, "... land, its resources, flora and fauna and also other nature resources are the national wealth and should be rationally used and protected by state".

On the basis of the Constitution, the laws are taken by Oliy Majlis (OM), signed by the President of the Uzbekistan and have the highest legal power. The President of the Uzbekistan, on the basis and in pursuance of execution of the Constitution and laws of the Uzbekistan, issues orders, statements and decrees, having compulsory power on the whole territory of the Uzbekistan (Article 94).

The Cabinet of Ministers (CM), in accordance with acting legislation, issues statements and decrees which are compulsory for the whole territory of Uzbekistan. The Khokim takes decisions which are compulsory for all ventures, establishments, associations, public officers and citizens on corresponding territory (Article 104).

The SCNP of the Uzbekistan is subordinated to OM and has responsibility for ministries, state committees, establishments and organizations for the use and protection of lands, subsoils, water, forests, flora and fauna, and air.

The fundamental legislative act regulating nature conservation is the Law "On nature protection" No. 754-XII dated December 9, 1992 (last revision was made by Law of Uzbekistan No.59 dated 10.10.2006). This Law states legal, economic and organizational bases for keeping conditions of environment, rational usage of nature complexes. It has the aim to provide balanced harmonic development of relations between humans and nature, protection of ecological systems, nature complexes and separate objects, and guarantee rights of citizens for favourable environment. The influence of economic activity on nature environment is limited by norms and quality standards established for various components of the natural environment. The aim is to guarantee ecological safety of population, production and protection of nature resources.

State control of environmental protection is carried out by public authorities and regulatory bodies and departments/agencies specifically responsible for nature protection. Authorized departments responsible for nature protection are:

- State Committee for Nature Protection of Uzbekistan;
- Ministry of Health of Uzbekistan;
- Agency for control of safe industry works and mines inspectorate;
- Ministry of Internal Affairs of Uzbekistan;
- Ministry of Agriculture and water resources of Uzbekistan;
- State Committee for land resources of Uzbekistan.

Payments for special nature management and pollution of environment consists of taxes and also, compensation payments for pollution of the environment (emissions, discharge of contaminants and wastes disposal), payments for protection and restoration of nature resources.

In addition to the Law “On nature protection” some other laws, regulating different areas of management and environmental protection have been developed such as:

- “On water and water usage” No. 837-XII dt May 6, 1993 (last revision was made by Law of Uzbekistan No. 240 dt 25.12.2009).
- “On protection of atmospheric air” No. 353-I dt. December 27, 1996 (last revision was made by Law of Uzbekistan No.59 dt. 10.10.2006).
- “On protection and usage of flora” No. 543-I dt. December 26, 1997 (last revision was made by Law of Uzbekistan No. 82-II dt. 26.05.2000).
- “On protection and usage of fauna” No. 545-I dt. December 26, 1997 (last revision was made by Law of Uzbekistan No.59 dt. 10.10.2006).
- “On wastes” No. 362-II dt. April 5, 2002.
- “On order of promulgation of a Land Code of Uzbekistan” No. 598-I dt. April 30, 1998. (last revision was made by Law of Uzbekistan No.714-II dt. 03.12.2004).
- “On state land cadastre” No. 666-I dt. August 28, 1998 (last revision was made by Law of Uzbekistan No. 621-II dt. 30.04.2004).
- “On woods” No. 770-I dt. April 15, 1999 (last revision was made by Law of Uzbekistan No.238 dt. 22.12.2009).
- “On protected nature territories” No. 710-II dt. December 3, 2004.
- Law of Uzbekistan “On subsoils” is approved by Law of Uzbekistan No.444-II dt. 13.12.2002r. (last revision was made by Law of Uzbekistan No.133 dt. 18.12.2007.)
- Law of Uzbekistan “On EIA” No. 73-II dt. May 25, 2000.

As a whole, ecological legislation of the Uzbekistan covers a wide spectrum of issues and includes regulations including:

- Protection of the environment and its main components;
- Protection of ecosystems and regulation of usage of nature resources;
- Evaluation of influence on environment and ecological expertise;

- Regulation of compensations for damage made to environment (including economical and administrative aspects);
- Regulation of property rights for nature resources.

The legislation of Uzbekistan prioritises a number of international agreements above the national legislation. For example, Article 53 of Law of Uzbekistan “On nature protection” requires that “in cases, when international agreement, concluded by Uzbekistan, states rules other than that contained in the present Law or other legislative act of Uzbekistan on nature protection, the rules of international agreement are applied, excluding cases when legislation of Uzbekistan established more strict requirements”.

3.3.2 Requirements of the National EIA Procedure

There are specific requirements as to the content, development procedure and examination of Environment Impact Assessment (EIA) documents. These are governed by the following legislative acts of the Republic of Uzbekistan:

- Law of the Republic of Uzbekistan No 754-XII dated 09.12.1992 “On Environment Protection”;
- Law of the Republic of Uzbekistan No 73-II dated 25.05.2000 “On Environmental Impact Audit”;
- Regulation “On State Ecological Expertise in the Republic of Uzbekistan”, approved by the Decree of the Cabinet of Ministers of the Republic of Uzbekistan No 491 dated 31.12.2001.
- A series of EIA documents consisting of the following stages are required to be developed for designed facilities in accordance with the given requirements:
- DEIA - Draft Environmental Impact Assessment, which shall be developed in the conception stage of planned or anticipated economic or other activity prior to the beginning of project financing (1st stage of EIA);
- EIA - Environmental Impact Assessment, which shall be developed if, based on the results of DEIA State Environmental Expertise (SEE), it was ascertained that additional surveys, on-site investigations, special analyses, simulation experiments and development of well-founded environmental actions are required (2nd stage of EIA). Necessity of EIA development shall be defined by State Committee on Nature Protection of the Republic of Uzbekistan based on the results of DEIA state environmental expertise.
- EEA - Ecological Effect Assessment, which shall be developed prior to commissioning of the project and shall be final stage of EIA procedure for designed facilities (3rd stage of EIA).

The Project is required to take all reasonable measures in accordance with these laws and standards in order to minimize any potential violations of general balance of environment, including, but not limited to, land surface, subsoils, air, lakes, rivers, flora and fauna, crops and other natural resources. The hierarchy of protection is determined in the following order: life protection, environmental protection and property protection.

3.3.3 National Social Legislation

The findings regarding the key legislation in relation to social matters were based on a revision of publicly available legislation translated into English.

The key findings are summarised below:

The **Constitution of the Republic of Uzbekistan,** in particular:

- Art. 105. Recognises makhallas as self-governing bodies whose Chairmen and advisers are elected by citizens for terms of two and a half years.4 This is relevant because this type of organisation is an important channel for the decision-making process of local communities. Makhallas carry out general initiatives and measures, including those connected with ecology, directly in villages, regions, districts and cities. The main principles of makhalla are democracy, publicity, social justice, humanism and mutual aid. A makhalla is responsible for taking decisions regarding problems of

[4] Constitution of the Republic of Uzbekistan http://constitution.uz/en/clause/index (20/02/2020)

local importance, including issues of improving and development of infrastructure, arrangement of khashars (voluntary unpaid work on Sunday) and provision of social aid to low-income families, among others.

- The Labour Code of the Republic of Uzbekistan of April 1,1996 (as amended on December 22, 2010); in particular:
- Chapter VI. Employment contract - Articles 4 and 72 to 76 determine the content, form and term of the employment contract, the limitation of rights of the employer to enter into fixed-term employment contract, and the ratio of legal and contractual regulation of labour relations. This is relevant because there is no specific requirement to provide workers with documented information that is clear and understandable, regarding their rights, including their rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.
- Article 77 determines the age at which employment is permitted (i.e. 16 years old).
- Article 239 establishes that all persons under the age of 18 years shall be employed only after undergoing a preliminary medical examination and further until reaching the age of 18 are subject to mandatory annual medical examination.
- Article 7 prohibits forced labour, understood as work performed under threat of punishment (including as a means of labour discipline).
- Articles 211 and 212 establish requirements on labour protection, and the duties of the employee to comply with the norms, rules and regulations on labour and protection. The employee is obliged to comply with the norms, rules and regulations on labour protection, as well as the administration of the order of safe operation, use the obtained personal protective equipment, and immediately notify their supervisor (foreman, master, chief of a site, and others) if any accidents or situations that create a direct threat to human life and health occur.
- Article 213 establishes the right of the worker to the information on occupational health and safety (OHS). At the conclusion of the employment contract and the transfer to another job worker shall be informed by the employer about working conditions, including the presence of risk occupational and other diseases due to him in connection with these benefits and compensation, as well as personal protective equipment. The employer must also inform employees or their representatives about the state of OHS in specific workplaces and production.

3.3.4 Archaeology and Cultural Heritage Legislative and Policy Context

Standards and legislation applicable to archaeology and cultural heritage are divided into two sub-sections, namely:

- National: Uzbek legislative and regulatory framework, and international protocols/agreements/ treaties to which Uzbekistan is party.
- International: International policies, standards and guidelines including the International Finance Corporation (IFC) Performance Standards and Environmental Health and Safety (EHS) Guidelines, and Good International Industry Practice (GIIP).

3.3.4.1 Uzbek Legislative Context

The principal legislation applicable to the archaeology and cultural heritage study comprise the Constitution of the Republic of Uzbekistan5, the Criminal Code of the Republic of Uzbekistan6, Law No. ZRU-229 “On protection and use of the objects of archaeological heritage” (13 October 2009)7, Law No. 269-II “On the Protection and Use of Cultural Heritage Sites (30 August 2001, as amended)8, Presidential Decree No. R-5181 “On improving the protection and use of objects of tangible cultural and

[5] Constitution of the Republic of Uzbekistan (2017). Available at: http://www.gov.uz/en/constitution/
[6] Criminal Code of the Republic of Uzbekistan of September 22, 1994 No. 2012-XII (as amended on 03-12-2019) Available at: https://www.lex.uz/acts/111457
[7] Law of the Republic of Uzbekistan dated 13 October 2009 No. ZRU-229 “On protection and use of the objects of archaeological heritage”. Available at https://lex.uz/docs/1526179
[8] Law of the Republic of Uzbekistan dated August 30, 2001 No. 269-II “On the Protection and Use of Cultural Heritage Sites”. Available at: https://www.lex.uz/acts/10375#1526009

archaeological heritage" (16 January 2018)9 and Presidential Decree no. PP-4068 "Regarding the strengthening of the protection, management and enhancement of tangible and intangible cultural heritage" (19 December 2018)[10]. A summary of the applicable legislation that will be considered during the ESIA process is presented in Table 12.

Table 12. National legislation, standards and guidelines applicable to the archaeology and cultural heritage study

Law/Act/Regulation	Objective
Constitution of the Republic of Uzbekistan (2017)	The Constitution of the Republic of Uzbekistan (2017) states that "It is the duty of every citizen to protect the historical, spiritual and cultural heritage of the people of Uzbekistan. Cultural monuments shall have protection by the state" (Art. 49).
Criminal Code of the Republic of Uzbekistan	Article 132 states that the intentional destruction, destruction or damage of objects of tangible cultural heritage under state protection causing significant or major damage shall be punishable by a fine, obligatory community service or by correctional labour up to three years. Article states that violation of a grave or a corpse, as well as the seizure of objects located on a corpse, grave or burial ground, shall be punishable by a fine, by corrective labour up to three years, by restriction of liberty or imprisonment from three to five years.
Code of the Republic of Uzbekistan on Administrative Responsibility	Article 64 notes that the violation of the rules for the protection and use of objects of tangible cultural heritage shall be sanctioned by a fine on citizens and officials. Construction or destruction of protected cultural property real estate objects in protected areas in specially protected historical and cultural territories without obtaining permission shall be sanctioned by a fine or administrative arrest.
Law No. 269-II "On the Protection and Use of Cultural Heritage Sites (30 August 2001, as amended)	Regulates the protection and use of cultural heritage objects (CHO), which are the national property of the people of Uzbekistan. The law protects ensembles, sites, monuments, objects of tangible and intangible cultural heritage. The law defines objects of tangible cultural heritage as representing historical, scientific, artistic or other cultural value ensembles, sites and monuments; and objects of intangible cultural heritage as representing customs, historical, scientific, artistic or other cultural value, folklore (the art of word, dance, music, performance), as well as knowledge, skills, tools, artefacts related to them and folk arts and crafts, and cultural spaces. Tangible cultural heritage is divided into CHO of national and local historical, scientific, architectural, artistic and memorial significance. Designated cultural heritage comprises World Heritage properties, elements inscribed on the Representative List of the Intangible Cultural Heritage of Humanity, CHO on the State Register, historical and cultural reserves, museum reserves and historical settlements. These are maintained on the State Cadastre of tangible CHO and the List of intangible objects of intangible CHO.
Law No. ZRU-229 "On protection and use of the objects of archaeological heritage" (13 October 2009)	Regulates the protection and use of the objects of archaeological heritage. The state has exclusive right of ownership of the objects of archaeological heritage. Objects of archaeological heritage are subject to compulsory state registration. The Ministry of Culture issues field investigation permits and approves the scientific report for each permit issued. Specially authorised institutions in the field of protection and use of archaeological heritage objects (authorised agencies) approve the procedures for archaeological exploration, archaeological excavations and archaeological surveillance, issue open sheets and participate in the historical and cultural examination of archaeological heritage sites.

[9] Presidential Decree No. R-5181 of 16 January 2018 "On improving the protection and use of objects of tangible cultural and archaeological heritage". Available at: https://www.lex.uz/docs/3506339
[10] Presidential Decree No. PP-4068 of 19 December 2018 "Regarding the strengthening of the protection, management and enhancement of tangible and intangible cultural heritage". Available at: https://lex.uz/ru/docs/4113474

Presidential Decree No. PP-4068 “Concerning measures on preservation of objects of cultural and archaeological heritage” (19 December 2018)	Includes a ‘Road Map’ to radically improve the protection, conservation, scientific research, propaganda and rational use of tangible cultural heritage objects for 2019-2021.
Presidential Decree No. R-5181 “On improving the protection and use of objects of tangible cultural and archaeological heritage” (16 January 2018)	Required the creation of a national digital inventory, used as the basis for developing comprehensive measures to radically improve the protection, conservation, scientific study, promotion and use of objects of tangible cultural and archaeological heritage in 2018-2023.

The Constitution of the Republic of Uzbekistan (2017) states that “It is the duty of every citizen to protect the historical, spiritual and cultural heritage of the people of Uzbekistan. Cultural monuments shall have protection by the state” (Art. 49).

Article 132 of the Criminal Code of the Republic of Uzbekistan states that the intentional destruction, destruction or damage of objects of tangible cultural heritage under state protection causing significant or major damage shall be punishable by a fine, obligatory community service or by correctional labour up to three years.

Article 134 Criminal Code of the Republic of Uzbekistan states that violation of a grave or a corpse, as well as the seizure of objects located on a corpse, grave or burial ground, shall be punishable by a fine, by corrective labour up to three years, by restriction of liberty or imprisonment from three to five years.

Article 64 of the Code of the Republic of Uzbekistan on Administrative Responsibility[11] notes that the violation of the rules for the protection and use of objects of tangible cultural heritage shall be sanctioned by a fine on citizens and officials. Construction or destruction of protected cultural property real estate objects in protected areas in specially protected historical and cultural territories without obtaining permission shall be sanctioned by a fine or administrative arrest.

Law No. 269-II “On the Protection and Use of Cultural Heritage Sites (30 August 2001, as amended) regulates the protection and use of cultural heritage objects (CHO), which are the national property of the people of Uzbekistan. The law protects ensembles, sites, monuments, objects of tangible and intangible cultural heritage. The law defines objects of tangible cultural heritage as representing historical, scientific, artistic or other cultural value ensembles, sites and monuments; and objects of intangible cultural heritage as representing customs, historical, scientific, artistic or other cultural value, folklore (the art of word, dance, music, performance), as well as knowledge, skills, tools, artefacts related to them and folk arts and crafts, and cultural spaces. Tangible cultural heritage is divided into CHO of national and local historical, scientific, architectural, artistic and memorial significance.

Designated cultural heritage comprises World Heritage properties, elements inscribed on the Representative List of the Intangible Cultural Heritage of Humanity, CHO on the State Register, historical and cultural reserves, museum reserves and historical settlements. These are maintained on the State Cadastre of tangible CHO and the List of intangible objects of intangible CHO.

Law No. ZRU-229 “On protection and use of the objects of archaeological heritage” (13 October 2009) regulates the protection and use of the objects of archaeological heritage. The state has exclusive right of ownership of the objects of archaeological heritage. Objects of archaeological heritage are subject to compulsory state registration. The Ministry of Culture issues field investigation permits and approves the scientific report for each permit issued. Specially authorised institutions in the field of protection and use of archaeological heritage objects (authorised agencies) approve the procedures for archaeological exploration, archaeological excavations and archaeological surveillance, issue open sheets and participate in the historical and cultural examination of archaeological heritage sites.

The Presidential Decree “Concerning measures on preservation of objects of cultural and archaeological heritage” (19 December 2018) includes a ‘Road Map’ to radically improve the protection,

[11] Code of the Republic of Uzbekistan on Administrative Responsibility (1994, as amended) Available at: https://www.lex.uz/acts/97661

conservation, scientific research, propaganda and rational use of tangible cultural heritage objects for 2019-2021. Presidential Decree No. R-5181 (16 January 2018) required the creation of a national digital inventory, used as the basis for developing comprehensive measures to radically improve the protection, conservation, scientific study, promotion and use of objects of tangible cultural and archaeological heritage in 2018-2023.

3.3.4.2 Uzbek International Agreements and Conventions

Environmental and social conventions and agreements of relevance to archaeology and cultural heritage are outlined in Table 13.

Table 13. International environmental and social agreements and conventions of relevance to the archaeology and cultural heritage study

Agreement/ Convention	Objective	Status and Date of Signature
UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (Convention on Cultural Property) – 1970[12]	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.	15 March 1996 (ratification)
UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) – 1972[13]	To ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage on states' territories.	13 January 1993 (ratification)
UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage – 2003[14]	To safeguard and ensure respect for the world's Intangible Cultural Heritage, including raising awareness of the importance of intangible heritage and encouraging international cooperation and assistance.	29 January 2008 (ratification)
UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions – 2005[15]	Recognises 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.	15 November 2019 (ratification)

3.4 International Agreements

Uzbekistan is signatory to a number of international conventions and agreements relating to industry, development and environmental management.

[12] UNESCO 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property. Paris, 14 November 1970. United Nations Educational, Scientific and Cultural Organization http://www.unesco.org/new/en/culture/themes/illicit-traffic-of-cultural-property/1970-convention/
[13] UNESCO 1972 Convention concerning the Protection of the World Cultural and Natural Heritage. Paris, 16 November 1972. United Nations Educational, Scientific and Cultural Organization http://whc.unesco.org/en/conventiontext/
[14] UNESCO 2003 Convention for the Safeguarding of the Intangible Cultural Heritage. (Paris, 17 October 2003) United Nations Educational, Scientific and Cultural Organization http://www.unesco.org/culture/ich/index.php?pg=00006
[15] UNESCO 2005 Convention on the Protection and Promotion of the Diversity of Cultural Expressions. Paris, 20 October 2005. United Nations Educational, Scientific and Cultural Organization https://en.unesco.org/creativity/convention/2005-convention/2005-convention-text

Table 14 below lists some of the relevant international conventions and protocols to which Uzbekistan is signatory. Many of these are incorporated into the various International Finance Corporation (IFC) Performance Standards.

Table 14. International Environmental and Social Conventions Ratified by Uzbekistan[16]

Name of Convention	Date of Ratification
C029 - Forced Labour Convention, 1930 (No. 29)	13 July 1992
C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)	12 Dec 2016
C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98)	13 July 1992
C100 - Equal Remuneration Convention, 1951 (No. 100)	13 July 1992
C105 - Abolition of Forced Labour Convention, 1957 (No. 105)	15 Dec 1997
C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	13 July 1992
C138 - Minimum Age Convention, 1973 (No. 138)	06 Mar 2009
C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)	13 July 1992
C122 - Employment Policy Convention, 1964 (No. 122)	13 Jul 1992
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (IEA ID# 2793)	08/02/2002
Convention for The Protection of The World Cultural and Natural Heritage (IEA ID# 2812)	13/01/1993
Convention on International Trade in Endangered Species of Wild Fauna and Flora (IEA ID# 2814)	08/10/1997
Convention on The Conservation of Migratory Species of Wild Animals (IEA ID# 2896)	01/09/1998
Convention for The Protection of The Ozone Layer (IEA ID# 2982)	16/08/1993
Montreal Protocol on Substances That Deplete the Ozone Layer (IEA ID# 3021)	18/08/1993
Convention on The Control of Transboundary Movements of Hazardous Wastes and Their Disposal (IEA ID# 3042)	07/05/1996
Agreement on cooperation in the field of ecology and environmental protection (IEA ID# 2489)	08/02/1992
Agreement on Cooperation in The Field of Joint Water Resources Management and Conservation of Interstate Sources (IEA ID# 3113)	18/02/1992
Convention on The Protection and Use of Transboundary Watercourses and International Lakes (IEA ID# 3116)	03/12/2007
United Nations Framework Convention on Climate Change (IEA ID# 3126)	21/03/1994
Convention on Biological Diversity (IEA ID# 3128)	17/10/1995

[16] International Labour Organisation (ILO): Ratifications for Uzbekistan.
Website: http://ilo.org/dyn/normlex/en/f?p=1000:11200:0::NO:11200:P11200_COUNTRY_ID:103101 (date viewed: 28.02.2018)

Statute of the Interstate Commission for Water Coordination of Central Asia (IEA ID# 4765)	05/12/1992
Agreement on Joint Activities in Addressing the Aral Sea and The Zone Around the Sea Crisis, Improving the Environment, And Ensuring the Social and Economic Development of The Aral Sea Region (IEA ID# 3155)	26/03/1993
Convention to Combat Desertification in Those Countries Experiencing Serious Drought And/or Desertification, Particularly in Africa (IEA ID# 3188)	26/12/1996
Agreement on The Conservation of African-Eurasian Migratory Water birds (IEA ID# 3216)	01/04/2004
Agreement between the Government of Kazakhstan, the Government of Kyrgyzstan and the Government of Uzbekistan on management of water resources in Central Asia (IEA ID# 8452)	05/04/1996
Agreement on The Use of Water and Energy Resources of The Syr Darya Basin (IEA ID# 3279)	07/05/1999
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (IEA ID# 2793)	08/02/2002
Convention for The Protection of The World Cultural and Natural Heritage (IEA ID# 2812)	13/01/1993
Convention on International Trade in Endangered Species of Wild Fauna and Flora (IEA ID# 2814)	08/10/1997
Convention on The Conservation of Migratory Species of Wild Animals (IEA ID# 2896)	01/09/1998
Convention for The Protection of The Ozone Layer (IEA ID# 2982)	16/08/1993
Montreal Protocol on Substances that Deplete the Ozone Layer (IEA ID# 3021)	18/08/1993
Convention on The Control of Transboundary Movements of Hazardous Wastes and Their Disposal (IEA ID# 3042)	07/05/1996
Agreement on cooperation in the field of ecology and environmental protection (IEA ID# 2489)	08/02/1992
Agreement on Cooperation in The Field of Joint Water Resources Management and Conservation of Interstate Sources (IEA ID# 3113)	18/02/1992
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3.5 International Best Practice Guidelines

International lenders who are signatories to the Equator Principles (EPs) require projects that they finance to meet international standards. Beyond Uzbek legal requirements, the following international guidelines, regulations and policies will be followed and applied to the Project development and implementation:

- IFC Performance Standards (IFC, 2012).
- Environmental, Health & Safety (EHS) General Guidelines, including wastewater and ambient water quality, waste management and hazardous materials management, noise management, occupational health and safety, and construction and decommissioning guidelines (IFC, 2007a).
- EHS Guidelines for Electric Power Transmission and Distribution (IFC, 2007b).
- Asian Development Bank (ADB) Safeguard Policy Statement (ADB, 2009).
- EBRD's Environmental and Social Policy (ESP) 2019
- EIB Environmental and Social Standards

These are all specific policies, procedures, strategies and regulations designed for promoting sustainable development. These procedures include a detailed environmental review process prior to final approval of financing for the Project, detailed environmental guidelines, detailed health and safety requirements, procedures for social impact assessment and public consultation and information disclosure and many other issues, associated with project construction, operation and decommissioning. Many of the mitigation measures described in later sections of this ESIA are based on these requirements.

Of particular relevance is Principle 1 of the Rio Declaration of Environment and Development (United Nations, 1992c) states that "Human beings are entitled to a healthy and productive life in harmony with nature". Principle 18 requires that an impact assessment be undertaken.

Further detail relating to the IFC Performance Standards and African Development Bank Integrated Safeguards System are provided below.

3.5.1 Equator Principles and IFC Performance Standards

The Equator Principles (EP) apply to all new project financings with total capital costs of USD10 million or more across all industry sectors globally. The EPs represent a framework for project financing, which is underpinned by the revised IFC Performance Standards (PS).

The extent to which the EPs apply to a project depends on whether the country in which the project is located is "Designated" or "Non-Designated". Projects within Non-Designated countries such as Uzbekistan are required to follow the standards and guidelines as set out in the IFC PSs and Environmental Health and Safety Guidelines.

The IFC PS are detailed below:

- IFC PS1 – Assessment and Management of Environmental and Social Risks and Impacts.
- IFC PS2 – Labour and working conditions.

- IFC PS3 – Resource Efficiency and Pollution Prevention.
- IFC PS4 – Community Health, Safety, and Security.
- IFC PS5 – Land acquisition and involuntary resettlement.
- IFC PS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- IFC PS7 – Indigenous peoples.
- IFC PS8 – Cultural heritage.

PS 1 establishes the importance of assessment to identify the environmental and social impacts associated with development, effective community engagement and project information disclosure and consultation with local Project affected communities and environmental and social management measures. This ESIA Study has therefore been carried out to meet the requirements of IFC PS1 as applicable to this stage of assessment.

The remaining IFC PS set out objectives and requirements to avoid and minimize potential environmental and social adverse effects on the environment and to offset/compensate any residual effects. PS 2 to 8 have therefore been considered as part of the assessment process and discussed where relevant within the topic specific sections below. PS7 has been scoped out of the assessment due to the absence of indigenous peoples in this area.

3.5.2 EBRD Performance Requirements

The environmental and social appraisal is based on provisions of the EBRD's Environmental and Social Policy (ESP) 2019 which reflects the fundamental principles of the European Union (EU) environmental legislation including EU directives that address issues of environment protection, social and environmental risk management, information disclosure and stakeholder engagement. All EBRD financed projects shall be structured to meet the requirements of the ESP.

The EBRD, as a signatory of the European Principles for the Environment (EPE), demonstrates its commitment to promoting sustainability and good international practice (GIP) in managing environmental and social risks by EBRD financed projects. For this purpose the EBRD's ESP 2019 adopts a set of specific Performance Requirements that projects are expected to meet with regard to key areas of environmental and social sustainability. Compliance with these requirements is mandatory for the Bank's borrowers.

3.5.3 EIB Environmental and Social Standards

The EIB Group Environmental and Social Sustainability Framework is an overarching policy framework that allows the Group to focus on sustainable and inclusive development, committing to a just and fair transition and supporting the transition to economies and communities that are climate and disaster resilient, low carbon, environmentally sound and more resource-efficient.

It consists of a Group-wide Environmental and Social Policy and a revised set of EIB Environmental and Social Standards, including a new Standard 11 on Intermediated finance, which describe the requirements that all EIB-financed projects must meet.

3.5.4 Asian Development Bank Safeguard Policy

The Asian Development Bank (ADB) Safeguard Policy Statement adopted in 2009 is aligned and consistent with the IFC policies, integrating previous ADB policies and Safeguard Requirements on environment, involuntary resettlement and Indigenous Peoples under it. In particular:

- Asian Development Bank (ADB) Social Protection Strategy (ADB, 2001)
- Asian Development Bank (ADB) Policy on Gender and Development (ADB, 2003)
- Asian Development Bank (ADB) Access to Information Policy (ADB, 2018)

ADB's Safeguard policies are generally understood to be operational policies that seek to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. ADB's safeguard policy framework consists of three operational policies on the environment, Indigenous Peoples, and involuntary resettlement. These are accompanied by Operations Manual sections on Environmental Considerations in ADB Operations; Involuntary Resettlement; and Indigenous Peoples.

In addition to the three safeguard policies, several sector policies have environmental safeguard elements, for example, those pertaining to water, energy, and forestry.

All three safeguard policies involve a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. The safeguard policies require that (i) impacts are identified and assessed early in the project cycle; (ii) plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and (iii) affected people are informed and consulted during project preparation and implementation. The policies apply to all ADB-financed projects, including private sector operations, and to all project components. The internal procedural requirements involve similar implementation processes as follows: (i) screening and scoping of the main issues start as soon as potential projects for ADB financing are identified and continue throughout the project cycle; (ii) impacts are assessed, safeguard plans summarizing mitigation measures, monitoring program, and institutional arrangements are prepared, and arrangements are made to integrate safeguards into project design and implementation; (iii) affected people are consulted during project preparation and implementation and information is disclosed in a form, manner, and language accessible to them; and (iv) safeguard plans are disclosed to the general public and the information is updated at various stages in the project cycle. ADB's safeguard policies require that both ADB's and DMCs' safeguard requirements are complied with.

The safeguard policies ensure that the lost assets are to be restored and/or compensated at full replacement cost together with appropriate assistance before the displacement of affected persons and the implementation and impacts of involuntary resettlement are to be monitored.

A basic principle of the three existing safeguard policies is that implementation of the provisions of the policies is the responsibility of the borrower/client. Borrowers/clients are required to undertake social and environmental assessments, carry out consultations with affected people and communities, prepare and implement safeguard plans, monitor the implementation of these plans, and prepare and submit monitoring reports. ADB's role is to explain policy requirements to borrowers/clients, help borrowers clients meet those requirements during project processing and implementation through capacity-building programs, ensure due diligence and review, and provide monitoring and supervision.

Considerable attention is devoted to the project processing and approval phase of the project cycle, although ADB's role in monitoring safeguard compliance continues during project implementation. ADB's project completion reports and project performance evaluation reports include review of the implementation of safeguards.

4. Impact Assessment Methodology

The objectives of an ESIA are to identify the potential project impacts, assess their significance and develop additional mitigation measures where needed. An initial assessment of impacts was carried as part of this scoping report. A number of criteria were used to determine whether or not a potential impact of the Project could be considered ‘significant’. These are outlined with reference to specific environmental and social issues in the subsequent topic chapters of this Scoping Report. Where this was not possible, a qualitative assessment of impacts was carried out, based on existing information available for the site and the surrounding study area, and experience with other solar PV developments.

Where relevant, the anticipated impact was compared against appropriate legal requirements and standards. Where no such standards exist, assessment methods involving interpretation and the application of professional judgement were employed. The assessment of significance in all cases accounted for the impact’s deviation from the established baseline conditions and the sensitivity of the environment.

The impact assessment will be developed further as part of ongoing ESIA studies being carried out at the pre-construction phase.

4.1 Baseline

Obtaining accurate and reliable baseline data within the Project Area of Influence is an essential component of the ESIA process, to provide a reference point against which potential impacts can be assessed and monitored. The approach to baseline characterisation is illustrated in Figure 4-1.

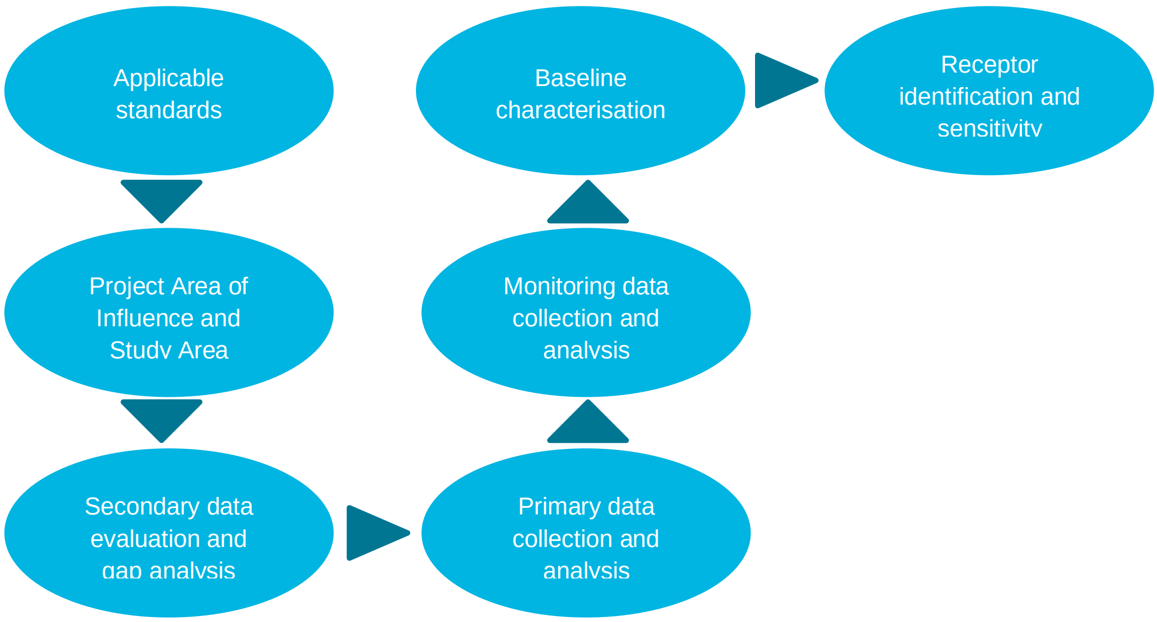

Figure 4-1. Approach to Baseline Characterisation

4.1.1 Project Area of Influence and Study Area

The initial step in the baseline characterisation is the definition of the Project Area of Influence (AOI) and the Study Area.

The AOI (based on the definition in IFC PS1 (IFC, 2012) adopted by the Project is:

The area likely to be affected by:

- Project activities and facilities that are directly owned, operated, or managed (including by contractors) by the Project Proponent and that are a component of the Project;
- Impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location; or

- Indirect Project impacts on biodiversity or on ecosystem services upon which 'Affected Communities'[17] livelihoods are dependent.

Associated facilities, which are facilities that are not funded as part of the Project and that would not have been expanded if the Project did not exist and without which the Project would not be viable. It is anticipated there will not be any associated facilities for the Project; and

Cumulative 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.

Using this definition of the Project components an Area of Influence was identified using the following criteria:

- Physical footprint of the Project, overhead lines and substation
- Area where noise effects may be experienced
- Area local to the Project that may be used as a resting/stopover point for migrating birds
- Area within the zone of theoretical visibility of the solar panels
- Area of 100 m either side of roads and access tracks
- Area of 100 m either side of overhead lines

A series of AOI maps will be prepared and will be used to identify survey areas, stakeholders and project affected peoples (PAPs) who would be targeted as part of the ESIA process. The AOI will then be used to guide the implementation of the ESIA study.

The term PAP is broadly defined as persons affected by land acquisition, relocation, or loss of incomes associated with change in land use due to a project.

4.1.2 Data Collection and Baseline Characterisation

The baseline characterisation of the physical, biological, and social environment is based on secondary (desktop research) data, supplemented by primary (field surveys) data where necessary.

As part of this scoping report, a desktop study was undertaken to collate available baseline data from published sources. The information was evaluated by the technical study teams and data gaps were identified. The desktop study was supplemented by field surveys undertaken in September 2021 at selected locations within the AOI.

Geographic information system (GIS) database have been developed to support baseline characterisation and impact assessment, incorporating remotely sensed data (satellite imagery and aerial photography), topographical maps, engineering drawings, and Geographical Positioning System (GPS) data linked to information collected in the field (e.g. photographs and field notes).

4.2 Impact Assessment

One of the key requirements of ESIA is to assess likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term permanent and temporary, positive and negative effects of the development.

Short-term effects are those considered to extend over a short period. In the context of this type of development, short-term relates typically to the construction and decommissioning periods. Effects lasting less than the life of the Project are considered to be medium-term whilst those over or exceeding the life of the Project are considered long term. Reversibility of effect; i.e. whether the effects will be reversible either wholly, or in part, in the short to medium term, are also considered where relevant.

The sensitivity of the receptor depends upon the relative importance of existing environmental features on or in the vicinity of the site or the sensitivity of receptors which have the potential to be affected by

[17] Local communities who are directly impacted by the Project.

the Project. The criteria for determining sensitivity or importance are based on existing guidance, legislation, statutory designation and / or professional judgement.

Following the assessment of receptor sensitivity, the potential impact on a receptor and the predicted magnitude of that change or impact was identified (i.e. the scale or degree to which the environment is affected from the existing situation). An example of the framework used to assess sensitivity and magnitude is given in Table 15 and Table 16 below. However, it should be borne in mind that the criteria depends on the specific environmental aspect being considered.

Table 15. Assessment criteria — sensitivity of receptor

Magnitude of Change / Impact	Criteria
High	Site or species subject to international or national protection.
Medium	Site or species subject to regional or local protection.
Low	Site or species subject to no specific protection measures.
Negligible	Site or habitat already significantly degraded.

Table 16. Assessment criteria — magnitude of impact

Magnitude of Change / Impact	Criteria
High	Fundamental change to the specific environmental conditions assessed resulting in temporary (long term) or permanent change.
Medium	Detectable change to the specific environmental conditions assessed resulting in non-fundamental temporary or permanent change.
Low	Detectable but minor change to the specific environmental conditions assessed.
Negligible	No perceptible change to the specific environmental conditions assessed.

The above tables will be used to determine the significance of impact. Significance is a function of the impact magnitude and sensitivity of the receptor. It is proposed to use the following matrix to determine sensitivity. It is noted that impact magnitude and receptor sensitivity will be defined qualitatively or quantitatively, depending on the methodology and nuances of the individual technical assessment topics. The methodology for determining magnitude and sensitivity will be clearly defined in the respective technical chapter.

Table 17. Assessment criteria — significance of impact

Magnitude of Change / Impact	High	Medium	Low	Negligible
High	High	High	Medium	Low
Medium	High	Medium	Low	Low
Low	Medium	Low	Low	Negligible
Negligible	Low	Low	Negligible	Negligible

4.2.1 Assessment of Cumulative Impacts

Cumulative impacts are an important issue to be considered for the Project. Cumulative impacts are those effects that may result from the combination of past, present or future actions of existing or planned activities. While a single activity may itself result in an insignificant impact, it may, when combined with other impacts (significant or insignificant) in the same geographical area and occurring at the same time, result in a cumulative impact that is significant.

Good practice requires that, at a minimum, project sponsors assess during the ESIA process whether their development may contribute to cumulative impacts and/or may be at risk from cumulative effects on valued environmental and social components they depend on. This will be done through a rapid cumulative impact assessment during the ESIA process and will follow of Environmental Management and Assessment (IEMA) EIA guidance, the Guidelines for the Assessment of Cumulative Impacts prepared for the European Commission and guidelines under IFC PS1 (IFC, 2013).

A rapid cumulative impact assessment was based on engagement with stakeholders as no publicly available information was identified. The identification of cumulative impacts was limited to those effects generally recognized as important on the basis of scientific concerns and/ or concerns of affected communities. AECOM have limited the projects being considered to those of $10M USD or over aligning with projects that would potentially fall under the scope of the Equator Principles.

As a first step, AECOM and GBI attempted to source planning information online but this information is not available. To identify potential developments that may result in a cumulative impact AECOM requested any information from the Khokimyiat on the site visit in December 2021 and with the individual Makhallas during the same visit. The area of search was at the district level (Sherabad) under control of the Khokimyiat. No relevant developments were identified during the initial consultation and the feedback from stakeholders was that there is a lack of such developments and hence a lack of employment opportunities. GBI undertook one final consultation with the Khokimyiat on 16 December 2022 who confirmed that there are no developments of a similar scale within the district.

No significant developments have been identified in proximity to the Project therefore cumulative impacts have been scoped out of the assessment.

4.2.2 Mitigation Design

When developing a project, and in particular when it comes to recommending mitigation which would involve changes to the project design – either physically or operationally – it is important to ensure that both the environmental and technical teams work closely together to develop solutions that will work in practise.

When considering the level of mitigation required the objective is to reduce the impact to a level which is deemed not significant.

If there are specific project parameters that must be adhered to then these have been defined by the Client so that mitigation is developed in line with an achievable project concept. Nevertheless, if there are opportunities to implement more robust mitigation measures which would deliver a better environmental outcome without impacting the viability of the project then these have been identified.

All mitigation measures will be guided by the mitigation hierarchy (Figure 4-2); a systematic approach to addressing environmental impact and its potential compensation. However, it should be noted that the ESIA Report contains an initial assessment of impacts based on the limited amount of data currently available. This assessment will be expanded upon as part of the ongoing ESIA process. Nevertheless, the key principles are:

- Identify the impact.
- Avoid the impact.
- Minimise the impact through appropriate mitigation measures. Mitigation can be achieved through project design or through on-site operational measures.

- Compensate for the impact by offsetting residual, unavoidable impacts primarily through on- or off-site restoration and improvement works. When implementing offsetting and compensation measures, the minimum objective should be no net loss or reduction in environmental quality.

Mitigation can be carried out by:

- *Structural measures*, such as design or location changes, engineering modifications and landscape or site treatment; and
- Non-structural measures, such as economic incentives, legal, institutional and policy instruments, provision of community services and training and capacity building.
- Structural measures are well established for large scale projects, such as energy generation, dams, roads, and oil and gas exploration and development. However, these will be applied with regard to the nature and severity of environmental impacts; for example, taking account of nearby protected areas, patterns of wildlife mitigation or constraints imposed by natural hazards. Some examples would include changes to track layout, module footprint, method of watercourse crossings or location of access point.

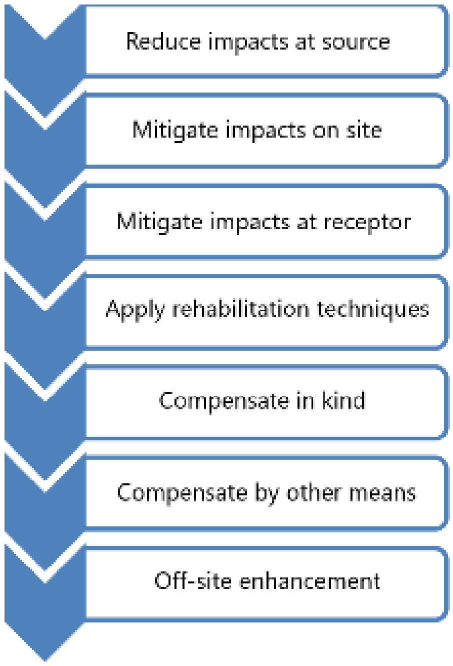

Figure 4-2. Mitigation hierarchy

Non-structural measures are used increasingly. They can be applied to reinforce or supplement structural measures or to address specific impacts. For example, many types of social, community and health impacts are addressed by non-structural measures and their use is becoming broader. A good example of this would be the requirement to develop a community benefits package.

The key steps in the mitigation hierarchy as described below.

Reduce impacts at source (Impact avoidance). This should be applied at an early stage of project planning. It can be achieved by:

- Not undertaking *certain* projects or elements that could result in adverse impacts;
- Avoiding areas that are environmentally *sensitive*; and
- Putting in place preventative measures to stop adverse impacts from occurring, for example, installing a free span bridge crossing rather than a pipe culvert to cross a watercourse.

Mitigate (Impact minimisation). This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- Scaling down the *proposal* i.e. reducing overall installed capacity;
- Redesigning elements of the project; and
- taking supplementary *measures* to manage the impacts, for example, installing bird diverters on overhead transmission lines.

Rehabilitation. This step is applied to mitigate unavoidable residual adverse impacts. It can be achieved by:

- Rehabilitation of *the* affected site or environment, for example, by habitat enhancement; and
- Restoration of the *affected* site or environment to its previous state or better.

Impact compensation and off-site enhancement. Both methods involve the principle of ensuring no net-impact *by providing a positive impact of the same magnitude as the negative impact from the project.*

- Provision of replacement land at an alternative location to compensate for loss of farmland (i.e. in-kind);
- Compensation equal to the lost revenue experienced as a result of the project; and
- Replacement of the same resource values at another location, for example, by habitat improvement to provide an equivalent area to that lost.

Mitigation and monitoring *measures* identified within the ESIA process will be carried forward and further developed within the Project's Environmental and Social Management Plan (ESMP) and associated sub-plans.

4.2.3 Assessment of Residual Impacts

Following the identification of mitigation measures to address significant adverse effects, an assessment of the significance of any residual effects (i.e. those remaining after mitigation) will be completed. Where significant residual impacts remain, consideration has been given to offsetting or compensating for residual impacts.

5. Stakeholder Engagement Programme

As part of the ESIA study, AECOM is carrying out a stakeholder engagement programme. The programme comprises several stakeholder engagement activities which aim to:

- Build and maintain stakeholder relationships.
- Gather information on the local environmental and social issues.
- Continue to disclose Project information (including any access restrictions, employment and procurement opportunities, and community health and safety issues).
- Monitor and evaluate stakeholder engagement.
- Provide stakeholders the opportunity to provide feedback.
- Manage grievances from the community and workers.

This section presents a summary of the stakeholder engagement programme, namely in two parts: previous engagement activities and future engagement activities.

The details of the stakeholder engagement programme as well as the applicable regulatory framework, the stakeholder identification and analysis process, and details of the Grievance Mechanism (GM), will be document in the Stakeholder Engagement Plan (SEP), currently under development. The SEP (and the engagement programme) is a 'live' document that will be updated as the Project progresses.

Issues identified during the stakeholder engagement process have been recorded in the assessment of impacts and appropriate mitigation has been developed where appropriate.

5.1 Previous Engagement Activities

5.1.1 Suntrace Initial Environmental Examination

German consulting firm Suntrace undertook the Initial Environmental Examination for the current Project from November 2019 - October 2020 and as such have already conducted some preliminary stakeholder engagement. It is important to understand the depth and breadth of these consultations prior to conducting any further engagement to build up a picture of which stakeholders have been consulted, what has been discussed, and crucially which stakeholders have thus far not been consulted. This will enable AECOM to tailor the stakeholder engagement programme for the ESIA to the project context.

5.1.1.1 Methods

Initial consultations with local stakeholders in the project area of influence were conducted in November 2019 before the commencement of any project activity to inform them of the proposed project and obtain feedback (Suntrace, 2020). The second round of consultations were conducted in December 2019 and January 2020 when the technical and local environment consultants / specialists conducted a number of field visits for primary and secondary data collection. Table 12 outlines the details of the individuals met during this second round of consultation.

Table 18. List of Individuals Consulted in Stage 2 of Suntrace's Environmental Examination

No. of Individual	Gender, age, occupation, place of residence	Date	Location
1	Man, 42 years, shepherd, Kuktash settlement.	7/3/2020	Karakyr upland- Solar plant site
2	Man, 30 years, shepherd.	7/3/2020	Karakyr upland- Chapanchi Mekhriyo settlement, Solar plant site
3	Man, 45 years, shepherd.	7/3/2020	Karakyr upland- Chapanchi Mekhriyo settlement, Solar plant site
4	Man, 60 years, shepherd.	11/3/2020	Karakyr upland-Muzrabat settlement

No. of Individual	Gender, age, occupation, place of residence	Date	Location
5	Man, 23 years, shepherd.	11/3/2020	Karakyr upland
6	Man, 60 years, Head of Buyuk Ipak Yuli settlement.	10/3/2020	Kampyrtepa, IBA Amudarya floodlands
7	Man, 63 years, shepherd.	11/3/2020	Karakyr upland- Yangier settlement
8	Man, 44 years, shepherd	11/3/2020	Karakyr upland-Yangier settlement, Solar plant site
9	Man, 44 years, shepherd.	11/3/2020	Karakyr upland-Solar plant site
10	Woman, 47 years, Head of Bogobod settlement, (this settlement locates to the North from Solar site).	11/3/2020	Karakyr upland-Solar plant site
11	Man, 57 years, famer.	12/3/2020	Karakyr upland-Solar plant site, Bogobod settlemen
12	Man, 65 years, Senior huntsman in Surkhandarya region, chief hunter at Aktepa hunting area (IBA Aktepa and three lakes).	9/3/2020	Dzharkurgan (transmission line

Source: Suntrace, 2020

5.1.1.2 Outcomes

The outcomes of these engagement activities yielded an understanding and appreciation of local and regional environmental and social issues. The main environmental issues identified during stakeholder consultations included increases in dust in the dry season and waste dumping associated with construction.

Social issues identified and discussed during stakeholder consultations included:

- The proposed site is not used for animal grazing; the locals have other designated areas for grazing their livestock.
- However, the area in and around the proposed transmission line is used for the livestock / animal grazing.
- Overall, the proposed project was highly welcomed by the interviewed stakeholders / villagers.
- The stakeholders / villagers expressed dire necessity of the project for their overall development of the villages in the area, including improved access to electricity, particularly during the harsh winters and hot summers and improved quality of life.
- The local stakeholders / villagers hope to gain temporary employment during construction stage and a number of permanent employment positions at the solar PV plant.
- The stakeholders expressed concerns regarding the potential of damage to existing roads during construction and safety concerns due to presence of transmission towers during the operation stage.

5.1.2 AECOM Scoping

During the preparation of the current Scoping Report a site visit was undertaken by the in-country project team which included some further stakeholder engagement activities. The site visit was conducted between 21st and 24th October 2021.

5.1.2.1 Methods

Stakeholder engagement is an important process at all ESIA stages however, it is particularly helpful to engage with relevant stakeholders during the early stages of the ESIA as their inputs can be considered in the assessment of impacts and the design of mitigation, management, and enhancement measures. A preliminary list of project stakeholders was identified prior to the site visit. Stakeholders identified include individuals, groups, and organizations that may be affected by or may influence project development, either positively or negatively. The list of project stakeholders will be continuously revised (expanded or reduced as necessary) throughout the ESIA study. The stakeholders identified and engaged with throughout the site visit are in Table 19.

Table 19. Stakeholder groups engaged during site visit

Stakeholder Group	Stakeholders
Local Government Representatives	• Deputy Khokim of Surkhandarya Region on Investments • Khokim of Sherabad District • First Deputy Khokim of Sherabad District • Cadastre of Sherabad • Head of Ecology of Surkhandarya region • Head of department of investments, Sherabad Khokimiyat • Chair of Bog'obod makhalla • Specialist on women issues of Bog'obod makhalla
Community Organizations	• Cemetery director
Community Representatives	• Bog'obod makhalla women • Leaders of Yangi er, Tong Yulduzi, Mehrgiyoh Makhallas
Land Users	• Farmers from Sherabad along the OHTL route • Farmer using land west of project area • Farmer 1 using land adjacent and within the project area • Farmer 2 owning the land within the project area
Community Members	• Bog'obod School №41 administration and teachers
Specialists, Academics	• Local Grid Representative • Head of Surkhandarya Geology department

At the start of each engagement session a brief overview of the Project was provided and the rationale for engaging with the specific stakeholders was explained. The format of the engagement varied depending on the number of stakeholder's present and the environment (i.e. on the project site or in a meeting room). The selected engagement methodologies included:

- Key Informant Interviews (KIIs): this methodology was used to engage one-to-one with local government representatives who are used to engaging with in this manner. This methodology was also used to engage with specific land users who would be impacted by the project in different ways.
- Focus Group Discussions (FGDs): this methodology was used to engage with specific groups of stakeholders who were likely to have similar concerns, priorities, and perceptions of the project and its likely impacts. This included community members, women, community leaders, and teachers.

The KIIs and FGDs both followed a semi-structured format with standard list of questions for each stakeholder. Stakeholders were then given the opportunity to ask questions of the ESIA Consultants. The project site map was used as visual aid where necessary.

5.1.2.2 Outcomes

Throughout the site visit a range of stakeholders a range of stakeholders were engaged with including local government (Figure 5-1), local schools (Figure 5-2), community leaders (Figure 5-3), and farmers (Figure 5-4). Notes were taken during each stakeholder meeting. Key issues discussed at each meeting are presented in Section 6: Environmental and Social Baseline. Further details of these consultations are provided in the Project SEP, currently under development.

Figure 5-1. Meeting with the women of Bog'obod makhalla

Figure 5-2. Meeting with teachers and administration of School №41

Figure 5-3. Meeting with mahalla leaders of Muzrabad district

Figure 5-4. Meeting with farmers

5.2 Future Engagement Activities

The future planned engagement methods are divided into the following categories:

- **Notification methods:** Used to inform stakeholders and the general population of the SEP activities and the project development process.
- **Disclosure and consultation methods:** Used to provide information to stakeholders or to engage in a two-way dialogue by which information is shared with the stakeholders and these in turn can express their views and concerns about the project.
- **External grievance mechanism:** System to receive and facilitate resolution of the stakeholder's concerns and grievances about project-related issues.

Table 20 describes the proposed timeline for the stakeholder engagement during the ESIA phase and the tools that are proposed for each stakeholder engagement phase and for each type of stakeholder.

The draft SEP will be updated to account for ongoing engagement during construction and operational phases.

Table 20. Stakeholder Engagement Programme

Stakeholder Category	Stakeholder Engagement Methods	Location/ Timeline	Purpose	Consultation Disclosure Materials	Mean of Advance Notification	Responsibility
ESIA DISCLOSURE PHASE						
All stakeholder groups	• Disclosure online • Placement of paper versions of the ESIA in public places18 • Leaflets in public places • Media announcements	Location/Date: [TBC]	• Disclose and discuss the results of the ESHIA study online	Non-Technical Summary (NTS) of the ESIA online	• Media announcements • Website announcements	E&S Consultant (with support from the Client)
Regional Government Agencies	• One-to-one meeting	Location/Date: [TBC]	• Discuss/coordinate the public hearing event on the local ESIA results	Local ESIA package	• Personal interaction	E&S Consultant (with support from the Client)
Local libraries	• One-to-one meetings • Phone calls • Placement of paper versions of the ESIA in public places18 • Placement of leaflets	Location/Date: [TBC]	• Arrange disclosure of the local ESIA package	Local ESIA package	• Personal interaction	E&S Consultant (with support from the Client)
All stakeholder groups	• Public hearing event • Placement of leaflets in public places • Media announcements	Location/Date: [TBC]	• Comply with ESIA regulatory requirements • Disclose and discuss the results of the ESIA study	Local ESIA package NTS of the ESIA online	• Media announcements	Local authority and the Client (with support from E&S Consultant where necessary)
CONSTRUCTION PHASE						
All stakeholder groups	• Disclosure online • Placement of paper versions of the ESIA in public places[18] • Leaflets in public places • Media announcements	Location/Date: [TBC]	• Disclose and discuss the construction status and any major events due to take place (component delivery for example).	Notices	• Media announcements • Website announcements. • Notice posted in public locations	Client
Regional Government Agencies	• One-to-one meeting	Location/Date: [TBC]	• Disclose and discuss the construction status and any major events due to take place (component delivery for example).	Local ESIA package	• Personal interaction	Client

[18] Paper versions of the ESIA document will be placed in accessible public places in the local language for stakeholders to read. A register and comment box will be left with the ESIA document to record the member of the public who have consulted the ESIA and to attain any feedback/concerns the community have. This information will be shared with the Client so they can manage these issues as the project moves into the construction phase.

Local libraries	• One-to-one meetings • Phone calls • Placement of paper versions of the ESIA in public places[18] • Placement of leaflets and grievance foms	Location/Date: [TBC]	• Disclose and discuss the construction status and any major events due to take place (component delivery for example). • Advertise potential job opportunities • Collect grievance/comment forms	Local ESIA package	• Personal interaction • Notice posted in public locations	Client
All stakeholder groups	• Public event • Placement of leaflets in public places • Media announcements	Location/Date: [TBC]	• Disclose and discuss the construction status and any major events due to take place (component delivery for example). • Inform community of potential employment opportunities • Collect and provide feedback on potential grievances	Local ESIA package NTS of the ESIA online	• Media announcements • Notice posted in public locations	Client

6. Environmental and Social Baseline

6.1 Overview

6.2 AECOM Site Visit

The scoping Site visit was undertaken on 21–24 October 2021 and involved a walkover of the Project Site, the area immediately surrounding the Site, and selected areas along the OHTL route. A second Site visit was undertaken on 29 November – 02 December 2021.

6.3 Physical Characteristics

6.3.1 Climate and Meteorology

The prevailing climate in Sherabad is a semi-arid climate (dry subtropical). The average temperature in Sherabad is 18.1°C (Suntrace, 2020). The average annual precipitation is 144.6mm characterised by small amounts of precipitation, with an uneven distribution over the seasons of the year (Suntrace, 2020). Most precipitation falls in the cold season (October-May). Air temperature has significant seasonal and daily amplitudes. The hottest months are between June to August; the coldest are between December to February. The maximum temperature falls in July (an absolute maximum of 47.4°C) and the minimum temperature is observed in January (absolute minimum minus 15.5°C) (Suntrace, 2020). In the warm period (July), north and south winds prevail at a speed of 3.4-3.2 m/s (Suntrace, 2020). The number of days with a dust storm and blowing snow per year is four. The standard value of the snow cover weight SO per 1m^2 of the horizontal surface of the earth is 0.5 kPa (Suntrace, 2020).

6.3.1.1 National Climate Change

Over the last century Uzbekistan's climate has warmed from 10.7°C in 1920 to 13.6°C in 2020 as illustrated by Figure 6-1. Observed Average Annual Temperature of Uzbekistan 1901-2020 (World Bank Group, 2021). This increasing trend represents a 2.9°C increase in air temperatures during the hundred-year period. This trend is consistent with the observations in other middle eastern countries which have historically been some of the worst affected by the impacts of climate change over the last 50 years (World Bank Group, 2021).

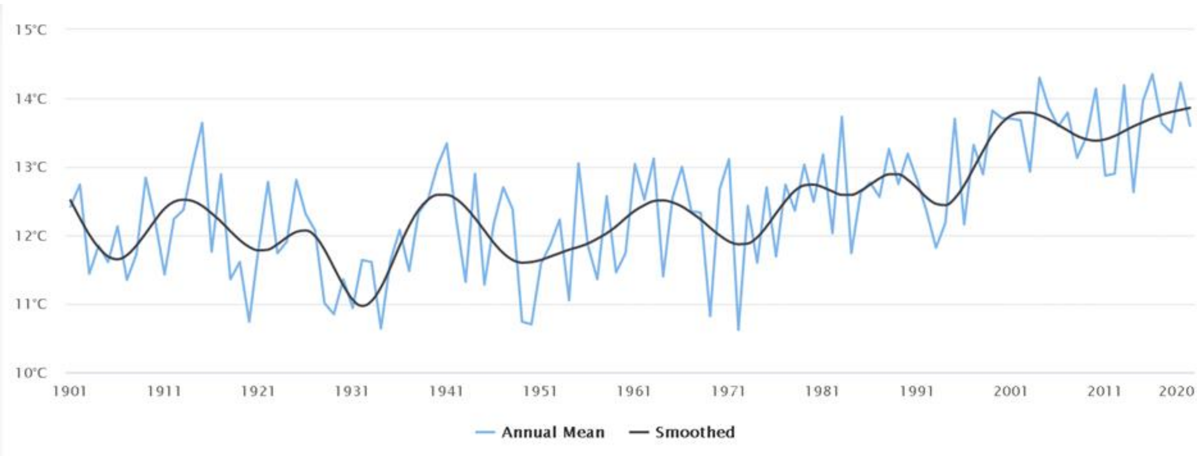

Figure 6-1. Observed Average Annual Temperature of Uzbekistan 1901-2020

Source: World Bank Group, 2021

Climate change is expected to produce increases in monthly maximum temperatures across Uzbekistan. Figure 6-2 illustrates a projected warming under the highest emission pathway (RCP 8.5) of 2.4ºC by mid-century and nearly 5ºC by end of the century (World Bank, 2021a). The number of hot days in Uzbekistan is projected to increase by 28.6 days by 2040-2059 days, under a RCP 8.5 scenario (World Bank, 2021a). Furthermore, the number of tropical nights, where temperatures remain above 20°C, is projected to increase by over 31 days between 2040-59 under the same scenario.

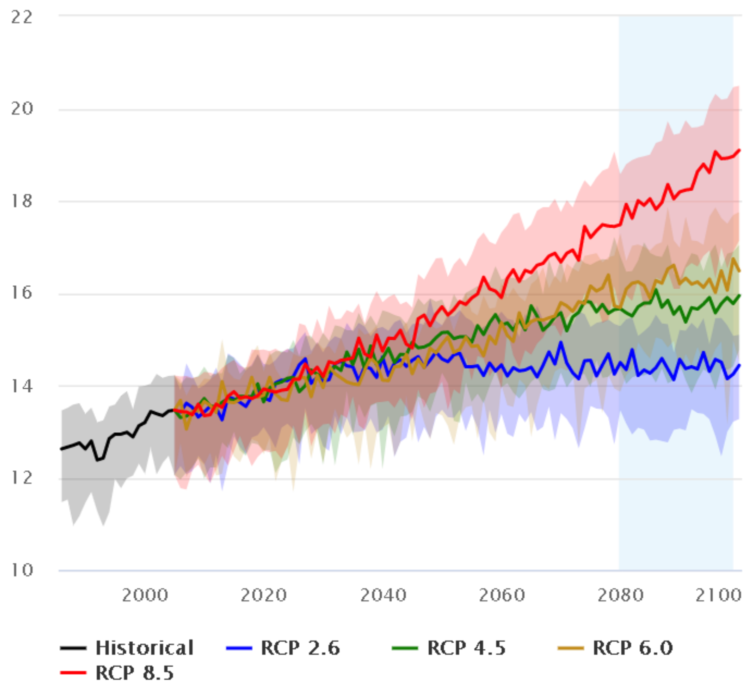

Figure 6-2. Projected mean-temperature in Uzbekistan from 1986-2199 under different emissions scenarios

Uzbekistan will experience a high variability of rainfall across different agroecological and climatic zones. In general, it is expected that precipitation will decline between 50-100mm in central and eastern districts while Mediumly increasing in regions near the Aral Sea (World Bank, 2021a). As a result of these projections, it is expected that Samarkand will experience reduced levels of precipitation due to its position ~820km south-east of the Aral Sea region. Increased heat and precipitation variability will lead to increased evapotranspiration in summer months resulting in a decrease in river flowing conditions. Moreover, future projections suggest that increased glacier melting is expected to impact water availability and river flow in the short to long term in Uzbekistan (World Bank, 2021a).

6.3.1.2 Local Climate Change

The project has been screened for future climate risks using a GIS based screening utilizing the UNEP PREVIEW data platform69 and the overall risk level is classified as low to Medium risk (Suntrace, 2020). The screening indicates that the project is located in districts that may experience potential increase in incidences of wind, dust storms and temperature.

6.3.2 Topography

The project area falls into the topographic classifications of plains (“chul”) and foothill (“adyr”) zones (Geographic Atlas of Uzbekistan , 2012). The site area is situated in the southeast direction of the western spurs of the Hissar Mountains. The undulating character of the plain is due to a combination of flat valley-like hollows, with their relative depressions up to 10-15m between them and the watersheds. Absolute elevation of the solar site ranges from 322 to 349m above sea level, a difference of 27m and surface slope is from north to south (GFP , 2020). Since the site terrain is mostly flat, it will require minimal levelling to elevate up to the engineering design. There is no hill cutting anticipated.

Figure 6-3. Topography of the area surrounding the Sherabad site

Source: Google Maps, 2021

Figure . Sedimentary ridges in southern Uzbekistan near the project site

Source: NASA, 2018

6.3.3 Geology and Soils

The area of influence is covered with layers of alluvial-deluvial and alluvial-proluvial rocks and the remains of sea salts (rocks of Cretaceous deposits) of middle and upper Quaternary age. The maximum depth of soil freezing is: 24 cm – possibility of occurrence once every 10 years and 30 cm – possibility of occurrence once every 50 years (Suntrace, 2020).

6.3.4 Climate Risks and Seismicity

The Surkhandarya region is susceptible to geophysical (earthquakes), meteorological (storms) and climatological (wildfires, droughts) events. For example, the project geophysical hazard risk is Medium for earthquakes; Climatological hazard risk is Medium for water scarcity and wildfires (Suntrace, 2020). Occurrence of extreme heat events is also High. Figure 6-4 presents the seismic zones in Uzbekistan. The Surkhandarya basin is prone to mudflows that may generally occur during the periods of intense rainfall or rapid snowmelt. The project area of influence is outside the susceptible areas as shown in Figure 6-5 for period 2005 to 2014; however, further investigations will be undertaken during detailed engineering design and findings will be included in the updated in the Final ESIA and ESMP (if available).

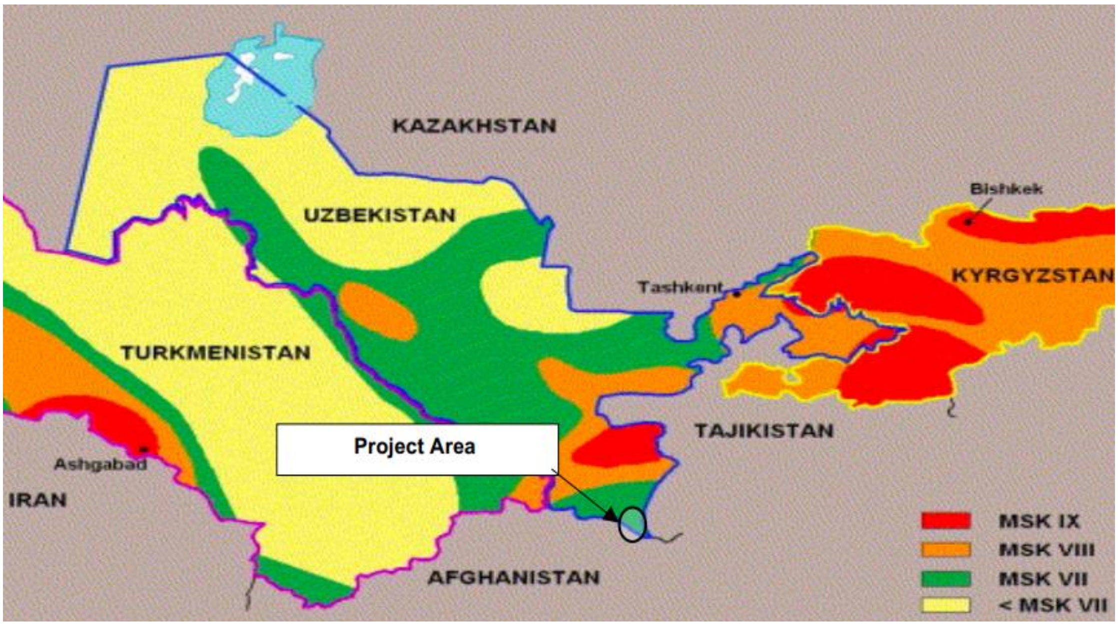

Figure 6-4. Seismic Risk Across Uzbekistan

Source: Suntrace, 2020

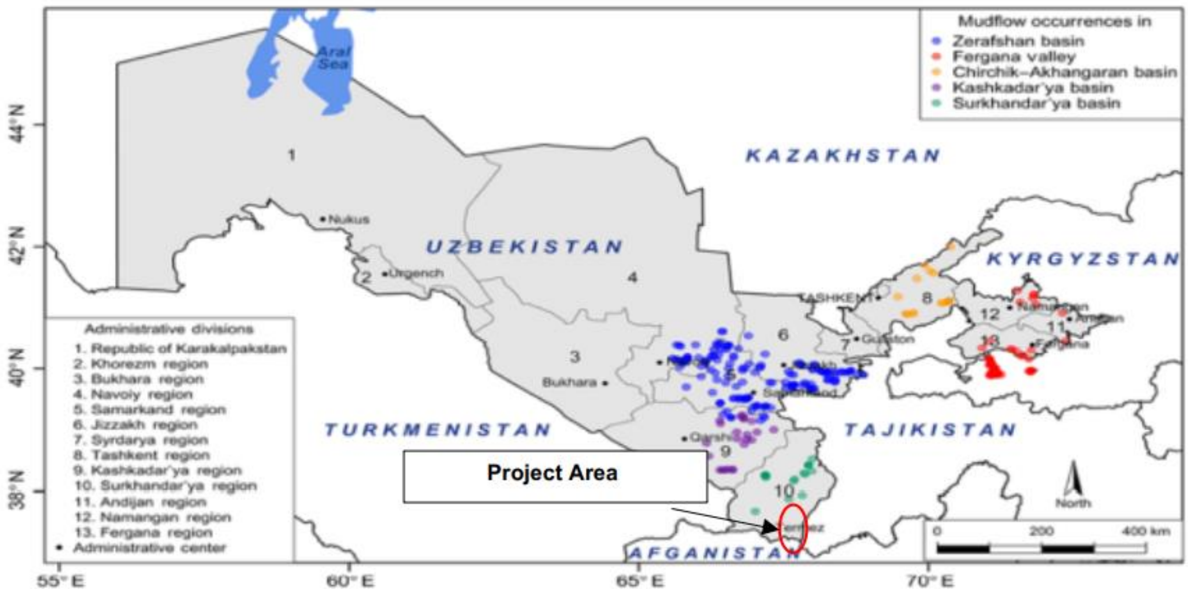

Figure 6-5. Mudflow Occurrence Across Uzbekistan

Source: Suntrace, 2020

6.3.5 Hydrology and Hydrogeology

6.3.5.1 Regional Hydrology

The site is in the wider Amu Darya District located 17km to the south of the project site. The Amu Darya is the second longest river in Uzbekistan spanning a distance of 879 miles across the country. The river is formed by the confluence of the Vakhsh and Panj (Pyandzh) rivers (the point at which it becomes known as the Amu Darya) and flows west-northwest. In its upper course the Amu Darya forms part of Afghanistan's northern border with Tajikistan, Uzbekistan, and Turkmenistan. It then flows across the desert of eastern Turkmenistan and in its lower course forms part of the boundary between Uzbekistan to the northeast and Turkmenistan to the southwest (Britannica , 2021).

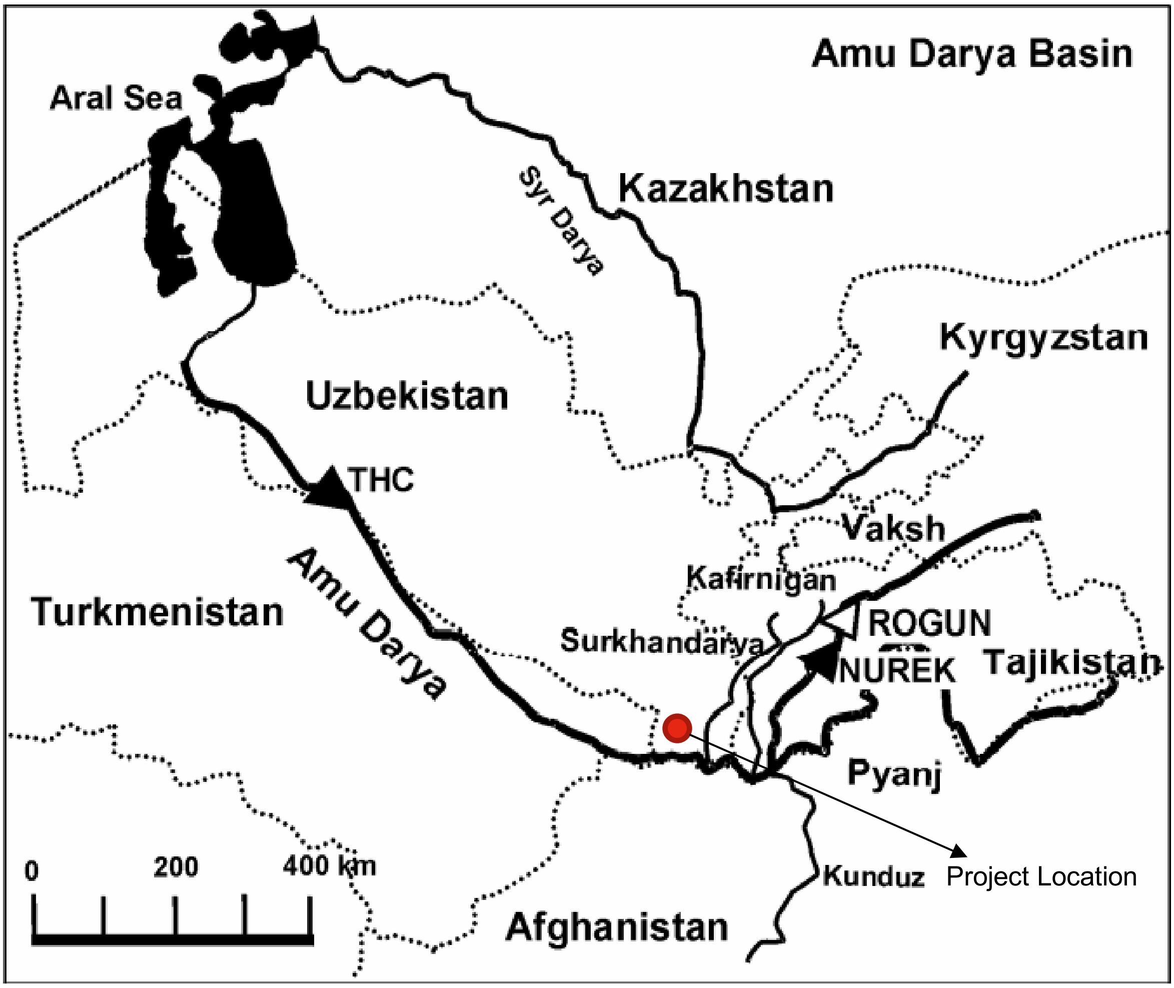

Figure 6-6. Amu Darya Basin with its major tributaries and dams

Source: Olsson, Bauer , Ikramova, & Froebrich, 2008

6.3.5.2 Local Hydrology

The site is framed by irrigation networks of the Amu-Zang canal from the south and drainage networks from the north, east and west; the drainage is also fed by the right branch of the Sherabad canal. The hydrological assessment shows the Amu-Zang canal has not previously discharged over its design flow and flooded the site (Suntrace, 2020). Some flooding may occur in the lower irrigated terraces, but these are located outside the site boundary. The final site engineering design will maintain the natural drainage pattern.

6.3.5.3 Groundwater

Groundwater quality analysis was conducted at the solar site to inform the environmental baseline. Groundwater table at site is at a depth of more than 8 m and is sulphate aggressive (Suntrace, 2020). The usage of groundwater will not be required, and abstraction prohibited.

6.3.5.4 Surface Water

There are no protected surface water bodies within the site or the project area of influence across the three districts crossed by the transmission line. There is an unlined irrigation channel outside the site boundary that separates the site in the south from farmland in the north. This will be conserved in its current natural condition by establishing a buffer of at least 50 m from the site fencing. The proposed transmission alignment will run across some man-made drainage canals and river Karasu (width of crossing 12.4 m) (Suntrace, 2020). A small fish pond is located on the south eastern edge of the Project site.

Figure 6-7. Irrigation canal on southern boundary

Figure 6-8. Fish pond outside southeastern boundary

Figure 6-9. Karasu River

6.3.5.5 Water Quality

The State Specialised Inspection of Analytical Control does not routinely monitor water quality. Surface water quality monitoring took place at two locations to inform the environmental baseline. Results are shown below.

Table 21. Surface water quality (g/l)

Water body	pH	CO_3^-	HCO_3^-	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	$Na^+ + K^+$
K696 collector	7.6		0.022	2.345	0.789	0.264	0.108	1.398
Zang canal	7.4		0.037	0.238	0.461	0.024	0.031	0.265

Source: Suntrace, 2020

6.3.5.6 Water Usage and Sources

The main source of water for household and drinking purposes in the region is the Sherabad river. In-house water supply is available to only 36% of the households in Sherabad district (Suntrace, 2020). Tap drinking water supply is available to 55% of all households in Kizirik district; and drinking water supply is via river Sherabad in Jarkurgan district (Suntrace, 2020). Three out of a total eleven villages along the proposed transmission line do not have piped water connection and hence, rely on spring water and purchased water for daily usage.

6.3.6 Air Quality

Field visits indicate that air quality in the project sites is good since these areas are located in rural setting without significant industrial or commercial zones, traffic volume to cause air quality degradation or high noise levels. This was also observed at the existing Surkhan substation site. Typically, in Uzbekistan, outside of main town centre there are few industrial pollution sources and the volume of vehicular traffic is low. There is no available air quality data or noise level measurements for the project districts and/or project sites.

6.3.7 Noise, Vibration and Light

The Solar PV Site is located in a rural setting in the vicinity of small villages. The soundscape is dominated by wind, sounds of wildlife, grazing animals, and human activities such as occasional cars passing by or through the Site. Nearest sources of light are associated with the nearby villages.

6.4 Landscape and Visual

The establishment of baseline conditions of the landscape and visual resource has involved a desk study subsequently verified through field work, GIS/computer analysis, and informed by local knowledge. This section provides a description and analysis of the existing landscape designations, landscape character areas/types, and existing visual resource. The Study Area contains a number of landscape and visual receptors, including settlements, local routes and a range of distinctive landscape elements.

Key terms used in this baseline description and subsequent impact assessment are:

- Landscape character areas (LCAs): Areas which are unique, discrete geographical areas of the landscape which demonstrate a series of recognisable features and characteristics.
- Visual amenity: The overall pleasantness of the views of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through the area.
- Representative viewpoints: Views selected to represent the experience of diverse types of visual receptor (such as local resident, recreational visitor, passer-by), where larger numbers of viewpoints cannot be included individually and where significant effects are unlikely to differ.

6.4.1 Baseline data collection

The extent of the study area is informed by the potential visibility of the Project in the surrounding landscape and is proportionate to its size and the nature of the surrounding landscape. For the purposes of this assessment an initial study area of 10 km has been chosen. Based upon this it is considered that it is highly unlikely that significant long-term residual effects will be possible from further than 10 km from the Site boundary.

6.4.1.1 Data Sources

The approach to the landscape and visual assessment has been devised to address the specific effects likely to result from a development of this scale and nature. The methodology draws upon the following established good practice guidance, based predominantly on UK guidance:

- UK Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013); and
- Visual Representations of Development Proposals, Technical Guidance Note 06/19 (Landscape Institute, 2019).

The landscape and visual assessments are primarily desk based and informed by Site photography. There are no published Landscape Character Assessments for Uzbekistan; therefore, for the purpose of this assessment, and in the absence of existing specific datasets, GIS and mapping have been used to develop landscape character areas relevant to this Project and Study Area.

It is proposed that the visual assessment be based on 6 viewpoints which will be selected to represent the experience of the different types of visual receptor where significant visual impacts are most likely to result.

6.4.2 Current landscape condition

The Solar PV Site is located at the top of a hilly plateau that stretches from northwest to southeast. The area is a dry steppe with sparce, low level vegetation, allowing for long views in all directions.

Key visual receptors are the nearby settlements.

Figure 6-10. Site landscape, December 2021

6.4.3 Landscape character areas

Desk based analysis identified three Landscape Character Areas within the 10 km study area. The description, key characteristics, likely trends and consideration of landscape value of each are detailed below. Project Landscape Character Areas are described in Table 22.

Table 22. Landscape character areas

LCA	Description
LCA1 Open plateau of historic agriculture	This is the LCA where the site is located. The LCA is a flat plateau mainly used for grazing with very limited arable cultivation on the very edges of the LCA. Visibility is extensive across the LCA particularly from the more elevated point in the centre. However, visibility into the LCA is often reduced by manmade features such as large earthen bunds created when digging the canals/collectors. There are few features within the LCA other than historic remnants of Soviet era agriculture. For example, a ruined irrigation system is present in the centre of the site. The LCA is crossed by some dirt tracks, infrequently used by locals.
LCA2 Arable farming with small settlements	This LCA is characterised by extensive agricultural fields, irrigation channels, roads and small settlements. Almost the entire area has been given over the agriculture. The main vertical features of the LCA are the houses and associated transmission lines with earthen bunds along the sides of irrigation channels. In particular there is an existing transmission line running east to west alongside the proposed route of the project transmission line.
LCA3 Khaudag Ridge	The LCA is characterised by a sandy dune habitat which has been anthropogenically altered by the presence of HV transmission lines running from the main substation to locations in all directions. Views from the top of the ridge to the west are extensive however there are a limited number, if any, receptors at this point. Human activity appears to consist of the illegal collection of shrubs for firewood.

Figure 6-11. LCA1 Open plateau of historic agriculture (from site centre)

Figure 6-12. LCA2 Arable farming with small settlements (2)

Figure 6-13. LCA3 Khaudag Ridge

6.4.4 Visual Receptors

Visual receptors within the scope of this assessment will be grouped into the following categories:

- Views from residential settlements;
- Transient views from nearby roads; and
- Views from recreational/access routes and places of interest.

6.4.4.1 Representative Viewpoints

A total of four representative viewpoints will be selected based on the visual receptor criteria above and where the Project is likely to affect views.

6.4.4.2 Representative Viewpoints

A total of three representative viewpoints were selected based on the visual receptor criteria above and where the Project is likely to affect views.

Table 23. Viewpoint Descriptions

Viewpoint ID	Location	Representative Receptors	Description
Viewpoint 1	In the centre of the site	Cemetery	This viewpoint is at an elevation of 347m ASL and representative of visitors and mounners to the cemetery located in the centre of the site. The VP is reached by minor road that bisects the project area. There are few verticle features in this VP with the overall character being the expansiveness of the view. Land slopes gently to the

			southeast point at 337m ASL providing good views in that direction. There is a small ridge at 353m ASL to the west that screens the western edge of the site from the VP however panles are likely to be visible about the horizon in that direction. In the farground to the north, the mountain range frames the view and provides the overall limit of verticle features. The solar panels will be viewed below the level of the horizon from north, south and easterly directions. Overall, receptors are expected to experience extensive views of the project which will become the dominant feature of the view from this location therefore the visual value is considered to be medium.
Viewpoint 2	100 m south of the nearest part of the Project Site boundary	Residential receptors	This viewpoint is representative of residents of the villages immediately south of the project site. At this location there is signifianct screening provided by an earthen bund most likely resulting from the excavation of the irrigation canal. This limits the views to the north. There are a number of vertical features including trees, buildings and transmission towers associated with the settlements. In this area the buildings become the dominant feature of the view. As noted, views of residents will be generally restricted by the topography, therefore the visual value is considered to be low.
Viewpoint 3	2.4km north of the closest part of the Project Site boundary	Residential receptors	The view, looking south towards the project, is representative of the small villages to the north of the project. These villages are at an elevation of 363m ASL and approximately 10-20 m above the elevation of the northern edge of the site. The foreground is comprised of areas of trees and buildings, bounded by trees and shrubs. The local road is predominantly used by local residents for access purposes. A disused irrigation channel located on the highest point on the site at 358m ASL runs perpendicular to the angle of view and screens the majority of the southern half of the site from this VP. Furthermore, at this distance, the project becomes a less distinct part of the view which is dominated by the buildings in the nearground. A high degree of screening is provided by vegetation and small undulations in landform. There is considerable screening provided by the existing vegetation and topography therefore the visual value is considered to be low.

6.4.4.3 Receptor Sensitivity

Landscape sensitivity to change has been determined by employing professional judgement to combine and analyse the identified value and susceptibility and has been defined with reference to the three-point scale outlined in Table 23.

Table 24. Sensitivity of Landscape Receptors

Classification	Criteria
High	Landscape of national or regional value with distinctive elements and characteristics, considered to have a limited ability to absorb the type of change proposed without fundamentally altering the key characteristics.
Medium	Landscape of regional or local value, or rarity, exhibiting some distinct elements / features, considered tolerant of some degree of the type of change proposed without fundamentally altering the key characteristics.

Low	Landscape with few distinctive elements / features or valued characteristics and considered tolerant of a large degree of the type of change proposed without fundamentally altering the key characteristics.

Visual sensitivity to change has been determined by professional judgement to combine and analyse the identified value and susceptibility and has been defined with reference to the three-point scale outlined in Table 22.

Table 25. Sensitivity of Visual Receptors

Classification	Criteria
High	Locations where receptors experience an impressive or well composed view containing few detracting elements, with limited ability to absorb change.
Medium	Locations where receptors experience a valued view which generally represents a pleasing composition but may include some detracting features and is tolerant of a degree of change.
Low	Locations where the view is incidental or not important to the receptors and the nature of the view is of limited value or poorly composed with numerous detracting features and is tolerant of a large degree of change.

Based on the above criteria, sensitivity of the site as a landscape receptor is considered to be low. The landscape is not protected and is not considered to be important in a local context. Existing man-made features (including power lines) further detract from the already low landscape quality. Owing to the arid nature of the environment and the fragility the soil often remains un-vegetated, detracting from the landscape character at the local scale.

Visual receptors are considered to be of low sensitivity given the screening provided by surrounding buildings and topography. The cultual receptor (cemetery) is assessed to be medium sensitivity. This is because the cemetery is surrounded on three out of four sides by solar panels and land surrounding the VP is flat, with very few trees, hedges or fences to obscure visibility, and as such visibility can extend for several kilometres. .

Sensitivity of the receptors is summarised in Table 23.

Table 26. Project Landscape and Visual Receptor Sensitivity

Receptor	Sensitivity
Landscape Character Areas	
LCA01	Low
LCA 02	Low
LCA 03	Low
Human Receptors	
Cultural receptor VP1	Medium
Residential receptor VP2	Low
Residential receptor VP3	Low

6.5 Biodiversity

6.5.1 Introduction

The Project site (the Solar PV site and the 52km overhead line grid connection (the latter is referred to as the 'Overhead Line' herein) is located in the Surkhandarya region of Uzbekistan.

The Solar PV Site is situated in the Karakyr Upland, at the foot of the Kelif-Sherabad Ridge; the landscape is characterised by shallowly sloping sandy and loamy (mixed with stones, salt or gypsum) deposits which are intersected with localised shallow gullies formed by erosion. The Solar PV site is bordered by a network of canals which separate the Karakyr Upland from irrigated agricultural lands; from the west, the territory is bordered by a shallow gully. A saltwort (*Salsola*) sub-shrub community has developed on historically cultivated land.

The Overhead Line is routed from the on-site substation at the Solar PV to the existing Surkhan substation in the Jarkurgan district to the east. It follows an existing overhead transmission line across agro-landscapes (cotton, what, alfalfa fields, orchards, vegetable gardens, tree lines, roads and network of drainage canals, households/settlements), Shuratakum Gorge, the Karasu River and the Khaudag Ridge. The approximate lengths for the Overhead Line in terms of the landscape areas listed above are as follows:

- Agro-landscape (0km at the Solar PV site to 9km);
- Shuratakum Gorge (9km to 13.3km);
- Agro-landscape (13.3km to 23.5km at Karusu River);
- Agro-landscape (23.5km to 36.2km); and
- Khaudag Ridge (36.2km to 52km at Surkhan substation).

The location of the Project Site in relation to the Shuratakum Gorge, the Karasu River, Khaudag Ridge geographical landscape (habitat) areas are shown Section 6.5.10.2.

6.5.1.1 Ecological Assessment -Asian Development Bank

The aforementioned landscape areas within the Project site support habitats for a wide range of species, particularly reptiles, birds and small mammals.

This section documents the ecological importance of the Solar PV site and identifies species and habitats, which have been determined by studies by the ADB and baseline surveys undertaken by AECOM, that should be subject to further mitigation during construction, operation and decommissioning of the Project.

Ecological field visits were undertaken for the Project between 3rd-13th March 2020 by Anna Ten (team leader), Timur Abduraupov, Natalyya Beshko and Valentin Soldatov to support an initial Critical Habitat and Impact Assessment report which was prepared by Suntrace for the Asia Development Bank (ADB)[19]. The following ecological survey reports were included as annexes to the Critical Habitat and Impact Assessment Report:

- Ten, A. et al. (2020). Ecological Survey/Season Bird Survey Report: prepared by Ten, A., Abduraupov, T., Beshko, N. and Soldatov, V.. Sherabad Solar IPP Project in Uzbekistan, Surkhandra Region - Annex 3 of the Critical Habitat and Assessment Report (Suntrace, 2020);
- Beshko, N. Yu. (2020). Evaluation of the Current State of the Flora and Vegetation in the Sherabad Solar IPP Project Territory – Annex 4 of the Critical Habitat Assessment Report (Suntrace, 2020); and
- Abduraupov, T.V. (2020). Evaluation of the Current State of Reptiles in the Sherabad Solar IPP Project Territory – Annex 5 of the Critical Habitat and Assessment Report (Suntrace, 2020).

[19] Suntrace (2020). Critical Habitat and Impact Assessment for the Asian Development Bank (ADB). Suntrace GmbH, 2020

The aforementioned Critical Habitat and Impact Assessment report and the ecological reports detailed above have informed the narrative relating to the ecological baseline conditions detailed below and the ecological assessment and mitigation requirements which are also detailed in this report. The Project Area of Influence (AOI) detailed within the Critical Habitat and Impact Assessment report is defined as a 50m buffer surrounding the Solar PV and new substation, with a 200m buffer around the transmission line Right of Way (RoW) centre line. Baseline ecological data was gathered by Suntrace within a 50km radius from the Project Site; only faunal and habitat data which is considered to be of potential relevance to the aforementioned AOI is included within this ESIA document.

6.5.1.2 Ecological Assessment - AECOM

The ecological baseline is also informed by the ecological field surveys and consultations undertaken by AECOM in 2021 and 2022. Further details of the AECOM surveys are provided in Section 6.5.8 (field survey methodologies), Section 6.5.9 (details of consultations which were undertaken) and Section 6.5.10 (Ecological Baseline).

6.5.1.3 Ecological Assessment – Turnstone Ecology

A Critical Habitat and Impact Assessment (CHA report) was prepared in August 2020 (Suntrace/ADB, August 2020) [refer to Section 6.5.1.1] and was further developed in the CHA prepared by Turnstone Ecology in 2022. The Critical Habitat Assessment (CHA) prepared by Turnstone Ecology has been completed in line with IFC Performance Standard 6 (PS 6) and EBRD Performance Requirement 6 (PR 6) and the corresponding Guidance Notes (GN), as well as the ADB Safeguarding Policy Statement to identify if sections of the Project area are considered as Critical Habitat; it is included in Appendix D.

This CHA aims to:

- identify Critical Habitat qualifying species or habitats, Priority Biodiversity Features (PBF) and Natural Habitat associated with the Project; and
- Highlight future actions for the Project where applicable, including identification and filling of data gaps and the need for additional field surveys as well as outline details to be included in a standalone Biodiversity Action Plan (BAP).

The CHA report is included in Appendix D.

6.5.1.4 Ornithological Assessment Overview

The likelihood of the Project site being used as a stopover and/or migration flyway for migrating birds has been investigated. The following sections provide further background information relevant to the assessment of ornithological baseline conditions and the assessment of potential impacts which are generally applicable for solar and power line projects:

- An overview of the potential 'lake effect' of solar panels is provided in Section 6.5.2.
- An overview of potential impacts of overhead powerlines on birds is provided in Section 6.5.10.2
- The key biodiversity areas (including areas which are important for birds) are detailed in Section 6.5.4.
- The details of migration flyways in Uzbekistan are provided in Section 6.5.5.
- A summary of the avifauna of Uzbekistan is provided in Section 6.5.7.

6.5.2 Potential 'Lake Effect' of Solar Panels

A number of unsubstantiated or unverifiable concerns have been raised in relation to the potential of solar PV arrays to mimic waterbodies resulting in bird collisions with the solar panels. The potential ornithological impacts of solar PV installations are poorly understood and there is no coherent guidance worldwide on the potential ecological effects of new and existing solar PV developments.

To date there are no experimental studies in the peer reviewed scientific literature that attempt to quantify the direct impact of PV solar farms on birds purely from an ecological perspective. The attraction of birds to solar PV installations was recognized as a concern by a focus group held to determine the potential hazards of large-scale PV development at airports (Wybo, 2013)[20]. The main attractant for birds recognized by Wybo (2013) was the potential for solar arrays to be used as nesting grounds; however, this claim was not supported with evidence. DeVault *et al.* (2014)[21] examined whether birds were more likely to use habitat at PV installations than nearby airfield grassland. The study stated that birds were rarely observed foraging on or near PV arrays. In terms of collision risk, DeVault *et al*. (2014) observed no obvious evidence for bird casualty caused by solar panels, despite conducting 515 bird surveys at solar PV sites.

Toral and Figuerola (2010)[22] state that the installation of solar farms on land used for rice cultivation would be detrimental to some water bird species. This claim is based on the study's findings that land used to cultivate rice in south-west Spain is used as habitat by some migratory water bird species, rather than any specific impact of solar farms. It is also suggested that the construction of solar farms will result in the loss of wetlands in southern Europe; however, no citation providing evidence of a negative impact of solar farms is presented. It is AECOM's view that the negative impacts reported are a result of changes to habitats and land use rather than the specific impact of any particular technology.

Photovoltaic panels have been shown to reflect polarised light that is attractive to polarotactic aquatic insects, which confuse solar panels with water and attempt to lay eggs on the surface, resulting in mortality and reproductive failure (Horváth *et al*., 2010[23]; Blahó et al., 2012[24]). Insectivorous predators have been recorded feeding on polarotactic insects attracted to sources of polarised light such as vertical glass windows, horizontal black plastic sheets and dry asphalt roads (Kriska *et al*., 1998[25]; Bernáth *et al*., 2008[26]; Horváth *et al*., 2009[27]). Bernáth *et al*. (2001)[28] describe birds such as black kite (*Milvus migrans*), great white egret (*Ardea alba*) and swallow (*Hirundo rustica*) attempting to drink from plastic sheets, hypothesising that this behaviour may be due to an attraction to surfaces reflecting polarised light. The study also describes the mortality of birds at a waste oil lake in Hungary, again attributing this to the direct attraction to polarised light or to insects attracted to polarised light. As solar PV panels are solid, if this hypothesis is correct, there is unlikely to be a significant hazard to perched birds attempting to drink, however Swallows and related birds could be presented with a collision risk as hirundines are known to drink 'on the wing' (Bryant *et al*., 1984)[29].

In summary, little scientific evidence exists that demonstrates a direct impact of solar PV on birds. It is likely that different avian species are likely to be affected differently by solar developments, dependent on the habitat within and around a solar PV development, the spatial requirements of a given species (e.g. flocking species that require large areas to host the flock) and the foraging behaviour of a given species.

[20] Wybo, J.-L. (2013) 'Large-scale photovoltaic systems in airports areas: safety concerns. Renewable and Sustainable Energy Reviews, 21, May, pp. 402–410.
[21] DeVault, T. L. *et al*. Bird use of solar photovoltaic installations at US airports: implications for aviation safety. Landsc. Urban Plan. 122, 122–128 (2014).
[22] Toral, G. M. and Figuerola, J. (2010) 'Unraveling the importance of rice fields for waterbird populations in Europe.' Biodiversity and Conservation. Department of Wetland Ecology, Doñana Biological Station, Avda. Américo Vespucio s/n 41092, P.O. Box 1056, 41080 Seville, Spain, 19(12) pp. 3459–3469.
[23] Horváth, G., Blahó, M., Egri, Á., Kriska, G., Seres, I. and Robertson, B. (2010) 'Reducing the maladaptive attractiveness of solar panels to polarotactic insects.' Conservation Biology, 24(6) pp. 1644–1653.
[24] Blahó, M., Egri, Á., Barta, A., Antoni, G., Kriska, G. and Horváth, G. (2012) 'How can horseflies be captured by solar panels? A new concept of tabanid traps using light polarization and electricity produced by photovoltaics.' Veterinary parasitology, 189(2-4) pp. 353–65.
[25] Kriska, G., Horváth, G. and Andrikovics, S. (1998) 'Why do mayflies lay their eggs en masse on dry asphalt roads? Water-imitating polarized light reflected from asphalt attracts Ephemeroptera.' The Journal of experimental biology, 201(Pt 15) pp. 2273–86.
[26] Bernáth, B., Kriska, G., Suhai, B. and Horváth, G. (2008) 'Wagtails (Aves: Motacillidae) as insect indicators on plastic sheets attracting polarotactic aquatic insects.' Acta Zoologica Academiae Scientiarum Hungaricae. Hungarian Natural History Museum, Budapest, 54(1) pp. 145–155.
[27] Horváth, G., Kriska, G., Malik, P. and Robertson, B. (2009). Polarized light pollution: a new kind of ecological photopollution. Frontiers in Ecology and the Environment. Volume 7, Issue 6. August 2009. pp 317-325
[28] Bernáth, B., Szedenics, G., Molnár, G., Kriska, G. and Horváth, G. (2001) 'Visual ecological impact of a peculiar waste oil lake on the avifauna: dual choice field experiments with waterseeking birdsusing huge shiny black and white plastic sheets.' Arch Nature Conserv Landsc Res, 40 pp. 1–28.
[29] Bryant, D. M., Hails, C. J. and Tatner, P. (1984) 'Reproductive Energetics of Two Tropical Bird Species.' The Auk. American Ornithologists' Union, 101(1) pp. 25–37.

A review was commissioned by Natural England (Harrison *et al*. 2017[30]) to gather evidence from scientific literature to provide a comprehensive report on current understanding of the potential ecological impacts of solar PV developments. The conclusions reached in the Natural England study has been referred to and the Solar Park was considered in terms of:

- the habitat available prior to the development,
- the habitat that will co-occur with the development; and
- the potential for attraction to polarotactic insect species (i.e. is the development close to a water body).

In the case of the Solar Park site being considered, there are no features nearby that would suggest that the habitat is particularly sensitive or attractive to migrating birds. There are two drainage canals close to the site that may attract polarotactic insect species and hence attract insectivorous bird species. However, only a limited number and type of species were recorded during site surveys. It is not considered that the Solar Park would result in an increase in species diversity. As a result, no features have been identified that could potentially increase the collision risk of migrating or resident species colliding with the solar panels. As noted in DeVault *et al*. (2014) no obvious evidence was identified of bird casualty caused by solar panels after conducting 515 bird surveys at solar PV sites. Therefore, it is AECOM's opinion that the Solar Park will not result in a 'lake effect' and poses no direct risk to migrating or resident birds. This suggested effect has not been considered further.

6.5.3 Overview of Potential Impacts of Overhead Powerlines on Birds

Mortality due to collision is considered to represent one of the most important adverse effects of overhead power lines on birds. Birds collide with power lines because they can be difficult to see, although the degree of collision risk depends on a number of factors. These relate to the species and their behaviour, various environmental factors and the type and design of the power lines. In the 'typical' wire arrangement for steel lattice tower supported high voltage lines it is the relatively thin earth wire (or ground wire) rather than the thicker conductors that is thought to present the greatest collision risk to birds (e.g. Alonso et al. 1994)[31]. Collisions are not thought to be random but are often concentrated in relatively short sections of a power line, where the various influencing factors can interact to create a collision problem or "hotspot" (e.g. Morkill & Anderson 1990[32]; Guyonne et al. 1998[33]).

Scottish Natural Heritage (SNH, 2016)[34] and Birdlife International (Birdlife, International, 2007[35]) have issued guidance regarding the effects of power lines on birds. Within this guidance, large and medium sized birds are highlighted as being the most sensitive (or potentially sensitive) to collision with overhead powerlines: storks, raptors, bustards, cranes, waterfowl and sandgrouse are included. This relatively high susceptibility of these species groups to collision is thought to be due to a number of ecological and biological factors such as: their need to regularly commute between separate roosting and foraging sites often in low light levels; their flocking and migratory behaviour; their large size and relatively poor manoeuvrability in flight; and their monocular vision (which reduces depth perception in

[30] Harrison, C., Lloyd, H. and Field, C. (on behalf of Natural England (2017)). Evidence review of the impact of solar farms on birds, bats and general ecology (NEER012). 1st edition - 9th March 2017

[31] Alonso, J.C., Alonso, J.A., Munoz-Pulido, R. (1994). Mitigation of bird collisions with transmission lines through groundwire marking. Biological Conservation 67: 129-134.

[32] Morkill, A.E. & Anderson, S.H. (1990). Effectiveness of marking powerlines to reduce sandhill crane collisions. Wyoming Cooperative Fish & Wildlife Research Unit Scottish Natural Heritage

[33] Guyonne, F., Janss, E., and Ferrer, M. (1998). Rate of bird collision with power lines: effects of conductor-marking and static wire-marking. Journal of Field Ornithology. 69: 8

[34] Scottish Natural Heritage [SNH] (2016). Assessment and mitigation of impacts of power lines and guyed meteorological masts on birds: Guidance, Version 1 (July 2016). Available at: https://www.nature.scot/guidance-assessment-and-mitigation-impacts-power-lines-and-guyed-meteorological-masts-birds

[35] Birdlife International (2007). Position Statement on Birds and Power Lines On the risks to birds from electricity transmission facilities and how to minimise any such adverse effects - adopted by the BirdLife Birds and Habitats Directive Task Force on 10 May 2007. Website: https://migratorysoaringbirds.birdlife.org/sites/default/files/BHDTF__Position_Power_Lines_and_birds_2007_05_10_.pdf

comparison to species with binocular vision). The main potential hazards to birds from overhead power lines are (SNH 2016, Drewitt & Langston 2008[36]):

Displacement of birds by the presence of new infrastructure (pylons, overhead wires), which may occur as both the deterrence of bird activity among and close to the pylons and also as a barrier effect to movement of birds across the Project area in the vicinity of new overhead wires. However, for the element of the Project that relates to replacement of existing overhead wires only, then negative impacts relating to barrier to movement are considered unlikely as birds are likely to have become habituated to the existing overhead wire and pylons;

Habitat loss, fragmentation and / or degradation resulting from the construction of new infrastructure (including the replacement of existing overhead wires and the elements of the Project which relate to new overhead line options); and

Increased bird mortality due to collision with new operational overhead line infrastructure, especially if sited close to congregation sites such as wetlands and migration bottlenecks.

6.5.4 Special or Protected Areas

Figure 38 illustrates the protected areas in relation to the proposed project. The analysis of protected areas comprises both nationally protected areas and internationally recognized zones with emphasis on Key Biodiversity Areas (KBAs).

The ecological survey findings identify one legally protected area in the region of analysis, the Surkhanskiy State Nature Reserve (IUCN Management Category Ia). This protected area is separated into two components, namely a small piece along the Amudarya flood-lands bordering Afghanistan 30 km south-east of the proposed solar site and a larger piece on the Kugitang Ridge located 22 km north-west of the solar site bordering Türkmenistan. The Kugitang State Nature Reserve exists in Türkmenistan adjacent to the northern component of the Surkhanskiy State Nature Reserve. These two components of the Surkhanskiy State Nature Reserve are located in fundamentally different habitats and support different species compositions and ecological processes. Limited biodiversity movement or ecological connectivity is expected between these areas.

Overall, five KBAs occur within 50km of the Project Site as follows (refer to Figure 6-14):

- The Kugitang and Baysuntay Mountains KBA - >40km from the Project Site at its closest point;
- The Amudarya flood-lands KBA - >10km from the Project Site at its closest point;
- The Koyendag KBA occurs within Türkmenistan and overlaps the Kugitang State Nature Reserve;
- Aktepe reservoir - >10km from the Project Site at its closest point; and
- Yuzhno Surkhan reservoir ->45km from the Project Site at its closest point.

The project AOI does not intersect any of these protected areas / KBAs. These protected areas are associated with either mountainous terrain or wetlands, and therefore support ecosystems that differ substantially from ecosystems within the study area. These protected areas are therefore not expected to be influenced by the proposed development and are not considered critical habitat features associated with the project.

[36] Drewitt, A.L. and Langston, R.H.W. (2008). Collision Effects of Wind-power generators and Other Obstacles on Birds. Annals of the New York Academy of Sciences 1134(1):233 – 266. DOI: 10.1196/annals.1439.015

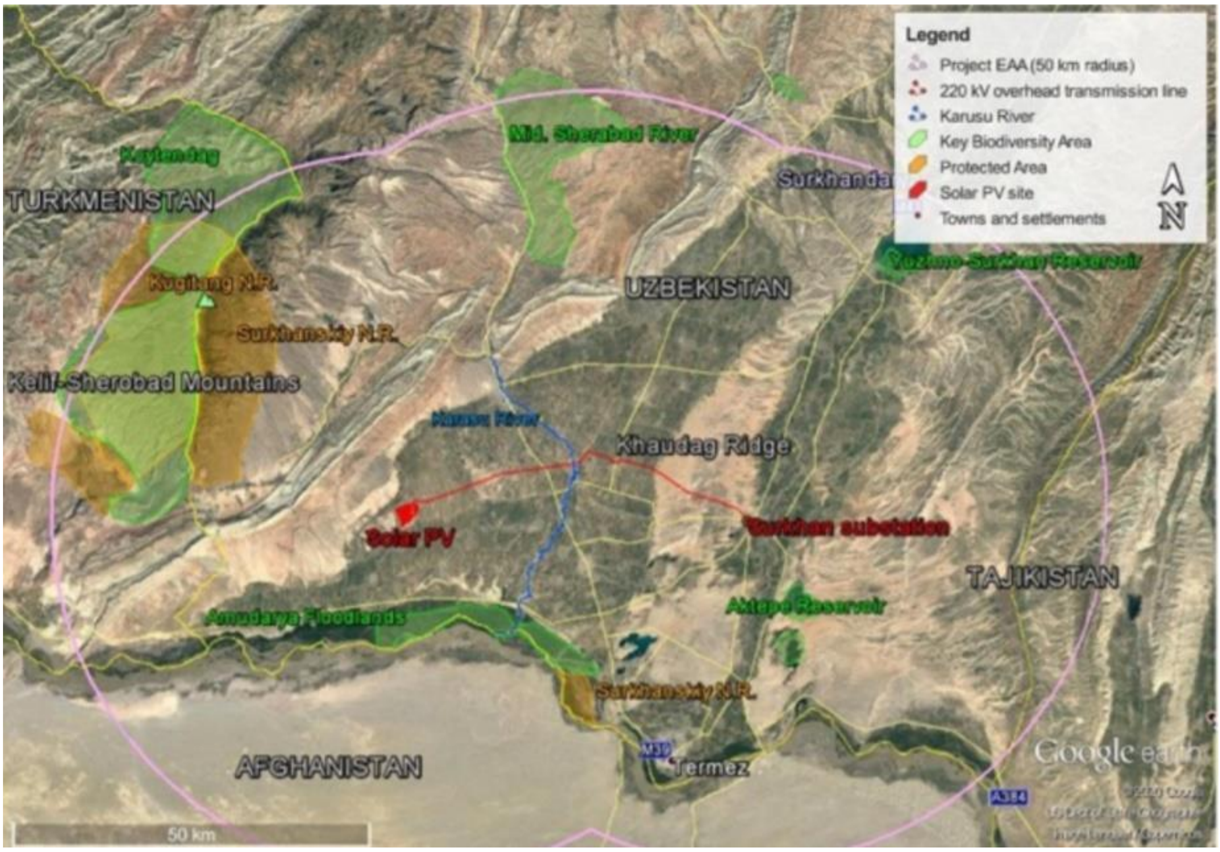

Figure 6-14. Ecological receptors in a 50km radius of the proposed development

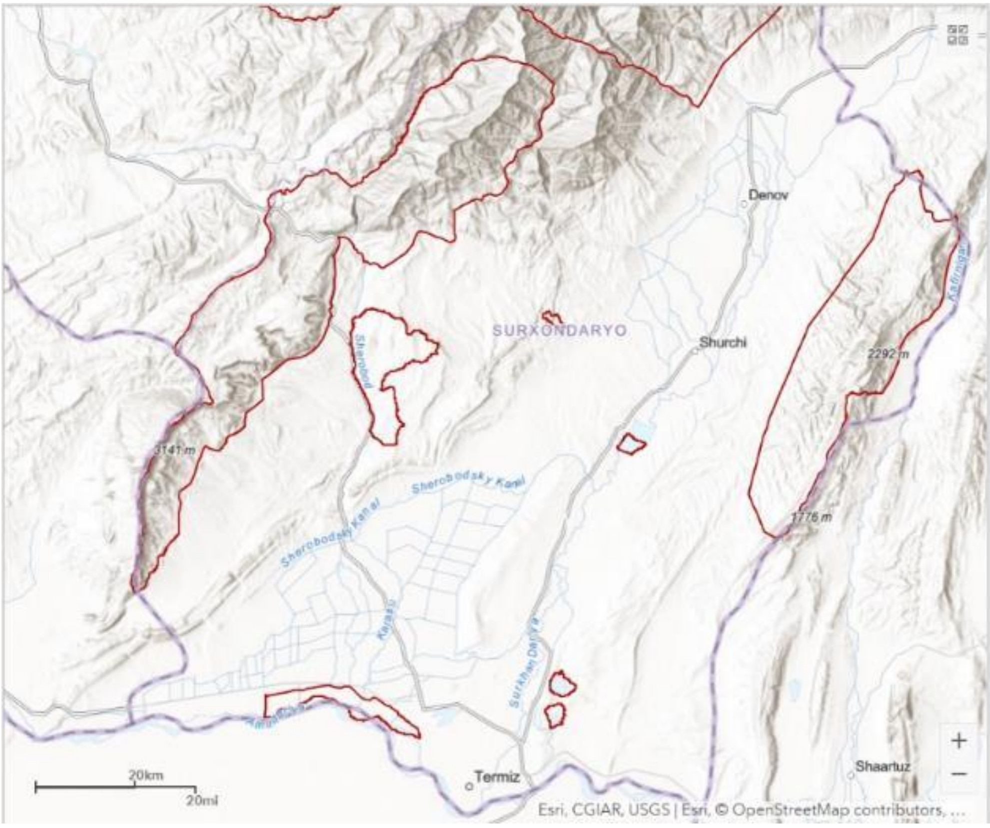

Figure 6-15. KBAs within the region of the proposed development

Source: KBA, 2021

The Amudarya Floodlands IBA[37]

The Amudarya Floodlands IBA (near Termez) is sited in the first floodplain terrace of the Amudarya river between Kaptarhona and Sholiker villages (on the border with Afghanistan). It is 1.5-6 km wide and about 30 km long. The Amudarya river is on the south and south-west boundary, loess precipices which border the first and second floodplain terraces, waterlogged areas and reedbeds are the natural borders of the site. There are also rice and winter wheat fields, sandbanks, rivers, stream, marshes, canals and roads. Approximately 230 bird species have been recorded, including the globally threatened *Pelecanus crispus*, *Anser erythropus*, *Aythya nyroca*, *Aquila clanga*, *Aquila heliaca* and *Tetrax tetrax*. *Phalacrocorax pygmaeus*, *Ciconia nigra*, *Ciconia ciconia*, *Haliaeetus albicilla*, *Aquila chrysaetos* and *Aquila nipalensis* are included in the National Red Data Book. This site is internationally important for wintering and migratory waterbirds. The dominant species are: *Anser anser*, *Anas platyrhynchos, Grus grus* and *Vanellus vanellus*. *Marmaronetta angustirostris* has also been recorded.

Mammals recorded in the area include jackal (*Canis aureus*), wild cats (*Felis chaus* and *Felis manul*), wild boar and the globally endangered Bukhara deer. There are house mice and green toads in the fields. Dice snake can be seen in the canals. There are catfish, crucian carp, common carp and the introduced snakehead. There are also 2 rare species of shovelnose sturgeon. There are reeds and tamarisk bushes on the banks. Wild poplar and clematis are reminders of former tugai forests. There are bushes of Iriantus along the canals and Karelinia in wet places. The majority of the site is covered with cultivated rice and winter wheat fields. Uncultivated fields are overgrown with reed and wormwood.

[37] BirdLife International (2022) Important Bird Areas factsheet: Amudarya floodlands near Termez. Downloaded from http://www.birdlife.org on 24/01/2022.

Middle reaches of the Sherabad River IBA[38]

The IBA is situated in the southern part of Uzbekistan in the valley of the Sherobad river and includes the adjacent mountains, 25 km to the north of Sherobad. The mountains are south-western branches of the Baysuntau ridge. The valley is narrow with adjoining foothills lacking forest-shrub vegetation. The IBA includes the river Sherobad and its valley: the primary and secondary terraces up to 3 km wide and the left part of the river basin. The arid treeless foothills become steeper to the north with many cliffs. The dominant vegetation is ephemeroid-wormwood associations, sometimes with *Ferula* sp, and in the hillier areas a tangle of bushes of wild acanthous almond. Breaking the landscape in some places are large mountain cones such as Kyzylkiya and the Ausyke hole. The rivers in the IBA are the Sherobad and the small Kamyshlau and Uzunkuduk, with high clayey cliffs and stony banks. There are also many dry rivers which fill with water only in spring. The bottomlands of the river Sherobad have short *Tamarix* sp. scrub and *Populus* sp. and sometimes short reed. There are agriculture strips up to 3 km width on the primary river terrace. Farm roads follow the bottom of the mountain rivers as a rule. There are small settlements with associated farmland and seasonal pastures.

There is good habitat for breeding raptors and the IBA is situated on a branch of a migration flyway. Numerous migrating flocks of common crane (*Grus grus)* and demoiselle crane (*Grus virgo)* have been observed flying north along the Sherobad valley and above the eastern slopes of the Kugitang range. Three species (*Coracias garrulus*, *Falco naumanni* and *Falco cherrug*) are included in the IUCN list of threatened species. Five species (*Ammoperdix griseogularis*, *Sitta tephronota*, *Oenanthe finshii*, *Phylloscopus neglectus* and *Emberiza buchanani*) are representatives of the Iranian-Turanian mountians biome. *Ammoperdix griseogularis* can only be found in this region of Uzbekistan.

6.5.5 Flyways

A number of important flyways cross Uzbekistan with the Project site lying on the Central Asian Flyway (CAF). The CAF covers a large continental area of Eurasia between the Arctic and Indian Oceans and the associated island chains. The Flyway comprises several important migration routes of waterbirds, most of which extend from the northernmost breeding grounds in the Russian Federation (Siberia) to the southernmost non-breeding (wintering) grounds in West and South Asia, the Maldives and the British Indian Ocean Territory. The birds on their annual migration cross the borders of several countries. Furthermore, the Asian–East African Flyway starts from the northern breeding grounds of water birds in Siberia and leads across Asia to East Africa. The larger African-Eurasian flyway covers a wider range of geographies starting from breeding grounds in Europe and Asia to wintering grounds in Africa.

[38] BirdLife International (2022) Important Bird Areas factsheet: Middle reaches of the Sherabad River. Downloaded from http://www.birdlife.org on 24/01/2022.

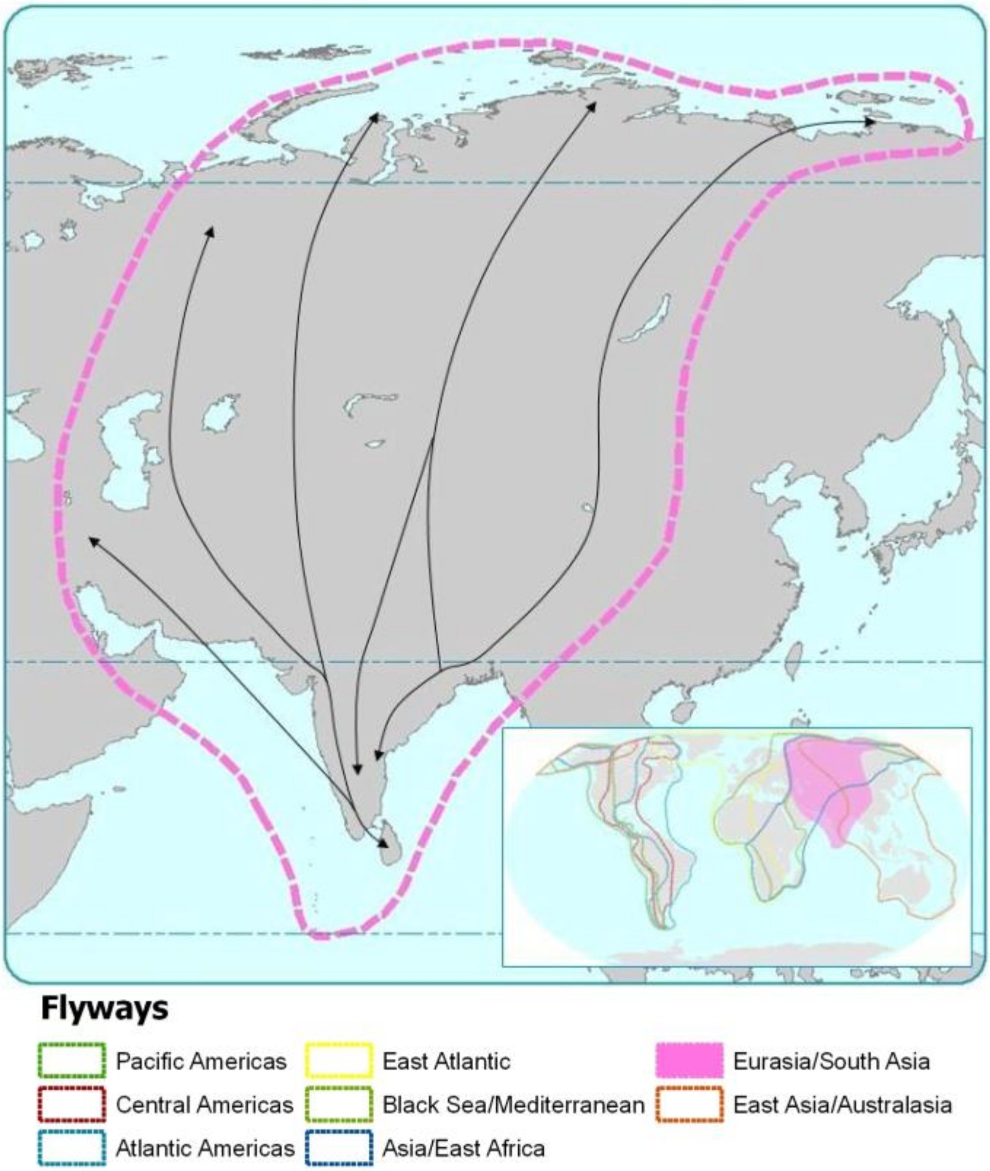

Figure 6-16. Important Flyways Relative to the Project site

Source: BirdLife International (2020) Central Asian Flyway

Geographically the CAF region covers 30 countries of North, Central and South Asia and Trans-Caucasus (including Uzbekistan). There is an overlap between the CAF and the area of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), which was concluded in 1995, at The Hague, the Netherlands. Sixteen out of the thirty countries encompassed by the CAF are located in the AEWA Agreement Area (including Uzbekistan).

Uzbekistan's natural and artificial wetlands are important for migrating and overwintering waterfowl (Lanovenko 2006). More than 50 migratory waterbird species have been recorded on Uzbek wetlands, including at least nine which are globally threatened: dalmatian pelican (*Pelecanus crispus)*, lesser white-fronted goose (*Anser erythropus)*, white-headed duck (*Oxyura leucocephala)*, ferruginous duck (*Aythya nyroca)*, white-tailed eagle (*Haliaeetus albicilla)*, red-breasted goose (*Branta ruficollis)*, marbled teal (*Marmaronetta angustirostris)*, Pallas's sea eagle (*Haliaeetus leucoryphus*) and pygmy cormorant (*Phalacrocorax pygmaeus)*.

Notable migratory species potentially using the flyway in the vicinity of the project area include the sociable lapwing (*Vanellus gregarious*) [see further information under 'Species of Concern' below].

The CAF is a broad front are there are no specific features within 20 km of the site which could attract migrating birds, with the exception of the Karasu River. The closest feature is the Amudarya Floodlands IBA which is attractive to migrating and wintering waterfowl, but the Project site does not contain any similar features that may attract such species. The Middle reaches of the Sherabad River IBA is situated on a branch of a migration flyway (eg. northward movement [spring migration] of common crane and demoiselle crane).

In summary, the proposed Project site is not located on a major bottle neck or geographical feature that would concentrate migrating species. The Karasu river valley has a north-south orientation and therefore there is potential that this geographical feature functions as a migratory corridor linking the Amudarya River (including the Amudarya Floodlands IBA), to the south, with the Middle reaches of the Sherabad River IBA, to the north; the latter supports migratory flyway ornithological features. However, the narrow and shallow river valley, which dissects an extensive flat plain, is not a geographical feature which is likely to coerce northward or southward migrating raptors, storks and cranes into concentrated migration along the Karasu Valley; migration is likely to be on a broad front across the plain between the Amudarya River (flows along the Uzbekistan-Afghanistan border) and the Kelif-Sherabad Ridge upland area to the north.

6.5.6 Avifauna of Uzbekistan Summary

Uzbekistan has a total of 352 bird species with 19 listed as globally threatened. 297 species are migratory with 55 resident species. The species that are most likely to be present, based on a review of desk-based information, are shown in Table 24 below. No species are listed as country endemics.[39]

Of the species below, one avian species categorised as Critically Endangered has been identified (IBAT 7 tool – using a 50 Km buffer) – sociable lapwing. The Tallymerjan area on the Uzbekistan/Turkmenistan border has been highlighted as a key stopover site for the eastern flyway, with all birds monitored on the eastern flyway using this site as a stopover site during their migration. It is possible that birds fly over the proposed project site, however it is considered unlikely that birds regularly use habitat surrounding the project as stopover sites during migration.

Table 27. Globally threatened bird species

Scientific Name	Common name	Family	IUCN Category
Oxyura leucocephala	White-headed Duck	Anatidae (Ducks, Geese, Swans)	EN
Anser erythropus	Lesser White-fronted Goose	Anatidae (Ducks, Geese, Swans)	VU
Melanitta fusca	Velvet Scoter	Anatidae (Ducks, Geese, Swans)	VU
Marmaronetta angustirostris	Marbled Teal	Anatidae (Ducks, Geese, Swans)	VU
Aythya ferina	Common Pochard	Anatidae (Ducks, Geese, Swans)	VU
Podiceps auritus	Horned Grebe	Podicipedidae (Grebes)	VU
Columba eversmanni	Yellow-eyed Pigeon	Columbidae (Pigeons, Doves)	VU
Streptopelia turtur	European Turtle-dove	Columbidae (Pigeons, Doves)	VU
Leucogeranus leucogeranus	Siberian Crane	Gruidae (Cranes)	CR

39 BirdLife International (2020) Country profile: Uzbekistan. Available from http://www.birdlife.org/datazone/country/uzbekistan. Checked: 2020-02-03

Otis tarda	Great Bustard	Otididae (Bustards)	VU
Chlamydotis macqueenii	Asian Houbara	Otididae (Bustards)	VU
Vanellus gregarius	Sociable Lapwing	Charadriidae (Plovers)	CR
Numenius tenuirostris	Slender-billed Curlew	Scolopacidae (Sandpipers, Snipes, Phalaropes)	CR
Neophron percnopterus	Egyptian Vulture	Accipitridae (Hawks, Eagles)	EN
Clanga clanga	Greater Spotted Eagle	Accipitridae (Hawks, Eagles)	VU
Aquila nipalensis	Steppe Eagle	Accipitridae (Hawks, Eagles)	EN
Aquila heliaca	Eastern Imperial Eagle	Accipitridae (Hawks, Eagles)	VU
Haliaeetus leucoryphus	Pallas's Fish-eagle	Accipitridae (Hawks, Eagles)	EN
Falco cherrug	Saker Falcon	Falconidae (Falcons, Caracaras)	EN

6.5.7 Bird Species of Concern Potentially Relevant to the Project Site

Further assessment was undertaken to determine the key species of concern which have the potential to be present within the AOI of the Project site; this is informed by the bird species which are detailed in the Critical Habitat and Impact Assessment (Suntrace, 2020) and Critical Habitat Assesssment (Turnstone Ecology, 2022), as recorded present or have a reasonable likelihood of occurrence. These species are listed below.

Marbled Teal (*Marmaronetta angustirostris*)

Restricted to the extreme south of Uzbekistan, this species appears to have suffered a rapid population decline, evidenced in its core wintering range, as a result of widespread and extensive habitat destruction. It is listed as Vulnerable (VU) by the IUCN. Threats include wetland drainage for agriculture and pollution from agricultural, industrial and domestic sources. When breeding, it is vulnerable to shooting, egg collection, entrapment in fishing nets and lead poisoning.

The Critical Habitat and Impact Assessment (Suntrace, 2020) for this duck species assessed that critical habitat is not triggered under Criterion 1(b) of IFC PS6: Globally important concentrations.

Also, the CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat or as meeting the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded any of the baseline surveys undertaken for the project.

Common Pochard (*Aythya ferina*)

This waterfowl species has a large range in both the breeding season and in winter, and a large population. Information suggests the population has declined rapidly across the majority of its range, and is projected to continue to decline, and it is therefore classified as Vulnerable by the IUCN (Birdlife International 2019).

The Critical Habitat and Impact Assessment (Suntrace, 2020) for this duck species assessed that critical habitat is not triggered under Criterion 1(b) of IFC PS6: Globally important concentrations.

Also, the CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat or as meeting the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded any of the baseline surveys undertaken for the project.

White-headed Duck (***Oxyura leucocephala***)

Listed as Endangered (EN) by the IUCN, this duck species is known to occur in Uzbekistan. It usually occurs within larger wetland systems where there are semi-permanent freshwater, brackish or eutrophic lakes with a fringe of emergent vegetation (BirdLife International, 2019). Major threats include the drainage of appropriate habitat and hybridisation with the north American ruddy duck. It is a migratory species.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat or as meeting the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during any of the baseline surveys which have been undertaken for the project.

Steppe Eagle (A*quila nipalensis*)

This species is widespread and occurs in Uzbekistan during its migration between breeding grounds further north and wintering grounds in Africa and on the Indian subcontinent. It is found predominantly in steppe and semi-desert habitats, feeding mainly on small mammals. It has been severely affected by the conversion of steppe habitat to agricultural lands and is adversely affected by power line and wind energy infrastructure. It is now listed as Endangered (EN) by the IUCN and Vulnerable (VU;D) on the Red Data Book of Uzbekistan.

The Critical Habitat and Impact Assessment (Suntrace, 2020) for steppe eagle assessed that critical habitat is not triggered under Criterion 1(a) of IFC PS6: Habitat of significant importance for CR and/or EN species. This species was recorded during the Suntrace (2020) ecological surveys in very small numbers and stated that ‘there is no evidence that greater than 0.5% of the global population could be present’.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during any of the baseline surveys which have been undertaken for the project.

Eastern Imperial Eagle (*Aquila heliaca*)

This species is a passage and winter visitor to Uzbekistan, with breeding populations occurring in Kazakhstan and Russia. It is listed as Vulnerable (VU) on the IUCN Red List and Vulnerable (VU;D) on the Red Data Book of Uzbekistan. Eastern imperial eagle is threatened at breeding sites by intensive forestry in the mountains and by a shortage of large indigenous trees in the lowlands (eg. illegal tree cutting in Russia). Other threats are loss and alteration of feeding habitats, shortages of small and medium-sized prey species (particularly ground-squirrels *Spermophilus* spp.), nest robbing and illegal trade, shooting, poisoning, electrocution by powerlines and collisions with vehicles.

The Critical Habitat and Impact Assessment (Suntrace, 2020) for eastern imperial eagle assessed that critical habitat is not triggered under Criterion 1(b) of IFC PS6: Globally important concentrations; this species is recorded as present during the Suntrace (2020) ecological surveys.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was recorded during the baseline surveys undertaken for the project (refer to Section 6.5.10.4 below).

Saker Falcon (*Falco cherrug*)

The Saker Falcon is listed as Endangered (EN) on the IUCN Red List due to electrocution from power lines, overexploitation for the falcon trade and habitat degradation. The estimated global population of the species is now between 12,200 and 29,600 individuals across its large range, with resident and breeding populations occurring in Uzbekistan. A specialist in hunting in open terrain landscapes such as semi-desert, steppe habitat and agricultural areas, it mainly hunts terrestrial rodents (BirdLife International, 2019). The species is listed as EN on the Red Data Book of Uzbekistan.

The Critical Habitat and Impact Assessment (Suntrace, 2020) for saker falcon assessed that critical habitat is not triggered under Criterion 1(a) of IFC PS6: Habitat of significant importance for CR and/or EN species. This species was not recorded during the Suntrace (2020) ecological surveys and is listed as possibly present.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during the baseline surveys undertaken for the project.

Pallas' Fish Eagle (*Halieetus leucoryphus*)

The Project area is within the native non-breeding range of this species which is listed as Endangered (EN) on the IUCN Red List. The species is closely linked to wetland, reservoirs and lake habitats and nests in trees near these water bodies. The eagle is listed as Endangered largely due to the continued loss and disturbance of wetland and breeding sites across its range, and there are now thought to be between 1000-2499 mature individuals globally. This species is not listed as a species that occurs within the Amudarya Floodlands IBA but this site provides suitable habitat for this species.

The Critical Habitat and Impact Assessment (Suntrace, 2020) for Pallas' fish eagle assessed that critical habitat is not triggered under Criterion 1(a) of IFC PS6: Habitat of significant importance for CR and/or EN species. This species was not recorded during the Suntrace (2020) ecological surveys and is listed as possibly occurring in transit.

Also, the CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat or as meeting the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN.

Egyptian Vulture (*Neophron percnopterus*)

The Project location is within the native breeding range of the Egyptian vulture. Across its large range it faces a variety of threats from lead poisoning, direct or secondary poisoning, electrocution from power lines, collision with wind turbines and reduced food availability due to habitat change and is listed as Endangered (EN) on the IUCN Red List and Vulnerable (VU;D) on the Red Data Book of Uzbekistan.

The Critical Habitat and Impact Assessment (Suntrace, 2020) for Egyptian vulture assessed that critical habitat is not triggered under Criterion 1(a) of IFC PS6: Habitat of significant importance for CR and/or EN species. This species was recorded during the Suntrace (2020) ecological surveys in very small numbers and stated that '*there is no evidence that greater than 0.5% of the global population could be present*'.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was recorded during the baseline surveys undertaken for the project (refer to Section 6.5.10.4 below).

Eurasian Griffon Vulture (*Gyps fulvus*)

This species has been subject to declines over its large global range and is threatened by persecution, unintentional poisoning through poison baits, reduction in food supplies and is vulnerable to the effects of wind energy development. It is listed as Least Concern (LC) by the IUCN but it is assigned as Vulnerable (VU:D) on the Red Data Book of Uzbekistan.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was recorded during the baseline surveys undertaken for the project (refer to Section 6.5.10.4 below).

Lammergeier (*Gypaetus barbatus*)

The main threats to this vulture species include non-target poisoning, direct persecution, habitat degradation, disturbance of breeding birds, inadequate food availability, changes in livestock-rearing practices and collisions with powerlines and wind turbines. It is listed as Neat Threatened (NT) by the IUCN but it is assigned as Vulnerable (VU:R) on the Red Data Book of Uzbekistan.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was recorded during the baseline surveys undertaken for the project (refer to Section 6.5.10.4 below).

Asian Houbara (*Chlamydotis macqueenii*)

This species is subject to considerable over-exploitation and declines have been estimated in a large proportion of its total population, thus globally it is estimated and projected to be in rapid population decline over three generations, starting in the past and continuing into the future. This species is therefore listed as Vulnerable (VU) by the IUCN (Birdlife International, 2019). It is listed as Vulnerable (VU:D) on the Red Data Book of Uzbekistan.

The Critical Habitat and Impact Assessment (Suntrace, 2020) for Asian houbara assessed that critical habitat is not triggered under Criterion 1(b) of IFC PS6: Globally important concentrations; this species is listed as having an unlikely presence and was not recorded during the Suntrace (2020) ecological surveys.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during the baseline surveys undertaken for the project.

Little Bustard (*Tetrax tetrax*)

The main threats are habitat loss, degradation and fragmentation, lack of food availability and nest failure due to modern agricultural practices.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was probably recorded during the baseline surveys undertaken for the project (refer to Section 6.5.10.4 below).

Great Bustard (*Otis tarda*)

This species has suffered rapid population reductions across most of its range owing to the loss, degradation and fragmentation of its habitat, as well as hunting; it therefore qualifies as vulnerable on the IUCN Red List. The species is suspected to have historically undergone a rapid population decline, owing to habitat loss and fragmentation for agricultural intensification, as well as hunting and collision with power lines. This species is a winter visitor or passage migrant in Uzbekistan. In the past birds from northern Central Asia overwintered in large numbers in Turkmenistan and Azerbaijan, as well as Uzbekistan, and north-east Iran, sightings are now rare in these countries (Kessler and Smith 2014)[40].

The Critical Habitat and Impact Assessment (Suntrace, 2020) for great bustard assessed that critical habitat is not triggered under Criterion 1(b) of IFC PS6: Globally important concentrations; this

[40] BirdLife International (2022) Species factsheet: *Otis tarda*. Downloaded from http://www.birdlife.org on 27/01/2022.

species was not recorded during the Suntrace (2020) ecological surveys but is listed as possibly present.The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during the baseline surveys undertaken for the project.

6.5.8 AECOM Ecological Baseline Surveys - Methodology

The ecological baseline (habitat identification, floral survey, terrestrial fauna and avifauna survey) within the Project site was established by AECOM ecologists and local biodiversity specialists[41] during a field survey visit on 29th & 30th November and 1st and 2nd December 2021 (referred to as the 'Winter 2021 Baseline Survey' herein). A second ecological baseline (habitat identification, floral survey, terrestrial fauna (including reptiles) and avifauna survey visit was undertaken within the Project site between April 1st-5th 2022 by local biodiversity specialists[42] (referred to as the 'Spring 2022 Baseline Survey' herein). These surveys included:

- Walkover transect surveys for birds, reptiles, mammals, habitat categorization and rare and endemic species of plants within the Solar PV site. The area was traversed in a regular pattern in order to reduce the chances of missing any important biotic features.
- Drive-over and point count surveys for the aforementioned ecological features along the Overhead Line within the agro-landscape landscape areas listed in Section 6.5.10.2.
- Walked transects at the Karasu River ravine for birds, reptiles, mammals, habitat categorization and rare and endemic species of plants for the Overhead Line route at the river crossing.
- Walked transects at the Khaudag Ridge Overhead Line crossing for birds, reptiles, mammals, habitats and rare and endemic species of plants for the Overhead Line route.

The Solar PV site footprint (being relatively small) was surveyed on foot with a series of transects running east to west and north to south directions. The area was traversed in a regular pattern in order to reduce the chances of missing any important biotic features. Additional baseline surveys were undertaken for Asian houbara; refer to Sections 6.5.8.4 below.

6.5.8.1 Habitat and Flora Survey

The aims of the Spring 2022 Baseline Survey, which was undertaken by local botanical specialists, are as follows:

- Determine the habitat type and plant species present at and around the proposed Project site and highlight any IUCN threatened species and/or species listed in the Red Data Book of Uzbekistan. The vegetation was sampled by the local botanical specialists along a transect route using 10mx10m quadrats, using the Drude method[43] for assigning vegetation cover and describing the vegetation type formations.
- Identify any exotic (non-native) or potentially invasive flora species.
- Identify the potential direct or indirect impacts, whether they are beneficial, adverse or neutral, on the current vegetation communities or protected species as a result of the construction and operation of the proposed Project.
- Identify feasible mitigation strategies as counter measures for the potential impacts.

[41] i) Fazlullo Agzamov, Research Specialist on Biodiversity, Research Institute of Ecology and Environmental Protection, Tashkent City Department of the State Committee on Ecology and Environment Protection and, ii) Bobur Choriyev, Student of Botany, Termez University.

[42] i) Fazlullo Agzamov, Research Specialist on Biodiversity, Research Institute of Ecology and Environmental Protection, Tashkent City Department of the State Committee on Ecology and Environment Protection, ii) Abdusalom Normatov, Senior Researcher (Botany), Forestry Scientific Research Institute, Tashkent, iii) Roman Nazarov, Herpetologist, Zoological Museum at Moscow State University and Research Institute of Animal Ecology at the Russian Academy of Sciences, iv) Alisher Atakhodjaev, Ornithologist, Biology Faculty at the National University RUz and, v) Bobur Choriyev, Student of Botany, Termez University.

[43] The Drude method is a description of vegetation in terms of its floristic composition and is generally accepted in terms of geobotany in Uzbekistan

Plant species were identified, and distributions were checked using relevant literature. The conservation status of each of the plant species documented was researched using the IUCN data bases. This was cross checked against the Uzbekistan Red List to determine the presence of species of conservation importance. The survey was undertaken in April 2022 and therefore within the optimal survey season (April-September) for undertaking habitat surveys.

The results of the April 2022 Baseline Survey were appraised by an experienced botanist/ habitat surveyor from the AECOM team involved with the Winter 2021 Baseline Survey visit.

6.5.8.2 Terrestrial Fauna Survey

The aims of the faunal study were to:

- Carry out field survey work to identify the terrestrial fauna that may reside or range within the region of the proposed Project site.
- Where possible, interview local residents regarding faunal species that may have been observed in the Project Site.
- Provide the IUCN Red Data rating and protected status in Uzbekistan for each of the fauna species determined to be present or potentially occurring at the Project site.
- Identification of any direct or indirect impacts, whether they are beneficial, adverse or neutral, on the current terrestrial biodiversity and provide relevant mitigation measures.

Considering that the activity patterns of many terrestrial species are hugely variable (i.e. many are nocturnal), it is possible that certain small species (particularly small mammals, reptiles and amphibians) could have been overlooked during the daily site surveys.

6.5.8.3 Avifauna Survey

The aims of the Winter 2021 Baseline Survey and Spring 2022 Baseline Survey for birds were to:

- Carry out field work to identify the micro-habitats within the proposed Project's footprint and identify the avifauna that may reside or frequent the area.
- Provide the IUCN rating for each of the fauna species determined to be present and protected status in Uzbekistan for each of the avifauna species determined to be present or potentially occurring at the Project site.
- Identify direct or indirect impacts to the local avifauna that could be the result of the construction and operation of the proposed Project.
- Determine relevant mitigation measures.

There are numerous factors that could influence the presence of avian species within the region such as season, weather conditions, and food availability. In order to account for this the bird distributions were researched to formulate an index similar to that used for terrestrial fauna species. In addition, the breeding and migratory habits were researched using Bird Life International databases to derive the species lists. Birds that could potentially frequent the proposed Project site have been classified according to their migratory, breeding and resident statuses. This scale uses the following terms:

- Resident: These birds reside and breed within the local areas on a more or less permanent basis though may move within their distribution zone
- Non-breeding migrant: These birds do not breed in this area however may be found in the region during certain periods/ seasons as they either use this area as a temporary or seasonal home range. This includes Eurasian wintering migrants.
- Breeding migrant: These birds frequent the region specifically to breed and raise their young, however following the breeding season will move on to other areas.

The Winter 2021 Baseline Surveys included the period for resident and non-breeding wintering migrants. The Spring 2022 Baseline Surveys included the period for breeding migrants and non-breeding migrants on spring passage through the Project site.

6.5.8.4 Asian Houbara Breeding Survey

Following consultation with the Asian Development Bank (ADB), a species-specific survey for Asian Houbara (*Chlamydotis macqueenii*) was undertaken by local biodiversity specialists[44] on 6th-9th April 2022.

The aim of the Asian Houbara breeding survey was to detect communal display areas (leks) in areas of suitable breeding habitat within the Project site following the methodology detailed in Sutherland *et al*, 1996[45]. The dates of the survey in early/mid April coincide with the optimal period for lekking activity. The aim was to confirm presence/absence of breeding populations of Asian Houbara within the Solar PV site and in areas of suitable habitat along the Overhead Line route, ie. where the route traverses the Shuratakum Gorge (near Khtay) and the Khaudag Ridge area. This species '*inhabits open, arid and sparsely vegetated steppe and semi-desert; it favours scattered shrubby vegetation, typically comprising xerophytic or halophytic plants*' (Birdlife International, 2022[46]). The intensive agricultural areas within the agri-landscape areas identified in Section 6.5.10.2 which support the proposed Overhead Line do not represent suitable breeding habitat for this species and therefore element of the project was scoped out of the survey.

In terms of the survey methodology, watches from vantage point (VP) locations were made in the early morning from elevated points using high powered optical equipment (telescopes mounted on a tripod (as well as binoculars)). The surveys coincided with the recommended timeframes as advised by ADB (ie. early mornings in April). The location of the VP's sought to avoid any disturbance to any lekking birds that may have been present. A desk-based survey reconnaissance (using aerial photography and topographical [contour] mapping) was undertaken by the survey team, with the purpose of determining potential vantage point, access arrangements and survey logistics.

The latitude and longitude co-ordinates for any lek sites used by Asian Houbara, and all other records/observations of this species, were recorded on a survey form and registered on a corresponding map.

Other bird species which were recorded incidentally during the April 2022 Asian Houbara survey were also recorded as part of this survey; this included breeding and migrating (spring passage) species. The following information was recorded for these records: species, number, behaviour and flight direction (if relevant).

Metadata for the Houbara surveys are provided in Table 25 below.

Table 28. Metadata for the Houbara surveys

Date	VP Number	Location	Co-ordinates	Time	Sunrise Time	Weather	Surveyors
6/04/2022	1	Solar PV	37°31'47.69"N 66°51'54.46"E	05:58-10:22	06:08	Sunny	AA & NA
06/04/2022	3	Khaudag Ridge	N 37.566344 E 67.286208	06:55-10:12	06:08	Sunny	FA & BG
07/04/2022	2	Shuratakum Gorge	37°34'24.75"N	05:50-10:42	06:04	Sunny	AA & NA

[44] Team Leaders – i) Alisher Atakhodjaev, Ornithologist, Biology Faculty at the National University RUz, and ii) Fazlullo Agzamov, Research Specialist on Biodiversity, Research Institute of Ecology and Environmental Protection, Tashkent City Department of the State Committee on Ecology and Environment Protection. Other ornithologists: i) Azimov, N.N. & ii) Ganiev, B.N.
[45] Sutherland, W.J (1996). Ecological Census Techniques: A Handbook. Cambridge University Press
[46] BirdLife International (2022) Species factsheet: Chlamydotis macqueenii. Downloaded from http://www.birdlife.org on 28/03/2022. Recommended citation for factsheets for more than one species: BirdLife International (2022) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 28/03/2022.

			66°59'26.34"E				
07/04/2022	3	Khaudag Ridge	N 37.566344 E 67.286208	06:45-09:55	06:04	Sunny	FA & BG
08/04/2022	1	Solar PV	37°31'47.69"N 66°51'54.46"E	05:22-10:38	06:03	Sunny	AA & NA
08/04/2022	3	Khaudag Ridge	N 37.566344 E 67.286208	05:58-09:23	06:03	Cloudy, 15-17ºC, NE wind (10 m/s)	FA & BG
09/04/2022	2	Shuratakum Gorge	N 37.573483 E 66.993197	05:41-10:05	06:01	Sunny	AA & NA
09/04/2022	3	Khaudag Ridge	N 37.566344 E 67.286208	05:50-09:10	06:01	A little cloudy, 20-22ºC, N wind (2-4 m/s)	FA & BG

6.5.8.5 Reptile Survey

A reptile survey was undertaken at the Project site by local herpetologist R. A. Nazarov between 1st-5th April and 22nd-26th April 2022; the findings are reported in Nazarov, R.A. (May 2022)[47]. A purpose of the surveys was to confirm presence/absence of reptile species of international and national conservation concern and an estimation of population density within the Project site, to inform the ecological baseline, impact assessment and mitigation for this assessment.

The surveys were undertaken in April and therefore within the active season for reptiles and therefore easier to detect.

The survey involved the surveyor walking a 12.4km line transect within the Solar PV site and the transmission line route during the daytime and also on a single occasion during the night-time; observations of tortoises, tortoise burrows and tortoise signs were recorded within distance bands so that population densities could be calculated.

6.5.9 Consultations

Goscomecology were subject to regular consultation throughout 2022. In addition, Samarkand Regional Ecology Department (included the respective Heads from the Regional Department of Ecology, Biodiversity Division, Expertise Division and Air Protection Division) [26th November 2021] were consulted.

6.5.10 Ecological Baseline

The ecological baseline detailed below has been informed by the results of the ecological surveys which were undertaken by Suntrace for the Asia Development Bank (ADB) in 2020, where relevant to the AoI of the Project. The results of the ecological field surveys undertaken by AECOM are also provided below; the results of consultation with statutory stakeholders and as a result of formal and informal liaisons with the local community are also included, where relevant.

A full species list for the fauna and flora recorded during the AECOM field surveys is provided in Appendix A.

[47] Nazarov, R.A. (May 2022). A Report on Potentially Affected Reptiles at the Project site in the Sherabad Region.

6.5.10.1 Habitats – Solar PV site

Habitat and floral surveys were undertaken by Beshko (2020); the following narrative provides a summary of the habitats and flora detailed in this botanical report for the Solar PV.

The Solar PV Site is situated in the Karakyr Upland, at the foot of the Kelif-Sherabad Ridge. The landscape within the Site is characterised by shallowly sloping sandy and loamy (mixed with stones, salt or gypsum) deposits which are intersected with localised shallow gullies formed by erosion. The Site is bordered by a network of canals which separate the Karakyr Upland from irrigated agricultural lands; from the west the territory is bordered by a shallow gully. A perennial saltwort (*Salsola*) sub-shrub community has developed on historically cultivated land, with localised areas, where there is little evidence of recent cultivation, supporting a higher cover of grasses with an isolated stand of tamarisk shrub near the eastern boundary.

Aridity and severe water scarcity hinder the development of both irrigation and rain-based farming. However, in the Soviet period, an unsuccessful attempt was made to develop agriculture more than 20-25 years ago within the Solar PV Site, which are evident by the ridge and furrows and historic remains of a network of canals; this formerly cultivated habitat covers over 50% of the site area. The vegetation that has regenerated on this fallow land is dominated by Saltwort sub-shrub forming the upper storey (20-40cm) of herbage. The lower storey (up to 10—15 cm from the ground), is composed of ephemeral plants, and graminaceous plants (mainly *Poa bulbosa*) and the sedge *Carex pachystylis*.

Localised areas of the site, which do not appear to have been ploughed or worked in any other way, are dominated by the same plants, but the leading position is taken by ephemeroid plants, mainly *Poa bulbosa*. Aridity and strong grazing has resulted in a very low projective cover, which is not higher than 10–20%. The vegetation is more or less uniform, with poor species composition, and the only differences between various portions of the site are slightly varying levels of projective cover and the proportion of Saltwort, and the absence or presence of some uncommon assectators, such as *Acanthophyllum pungens*. Horizontally, dominating plant species are distributed more or less evenly.

The north-eastern boundary of the Solar PV Site, immediately adjacent to the peripheral irrigation canal, supports a localised linear stand of the camelthorn (*Alhagi pseudalhagi*) -tamarisk (*Tamarix laxa*) shrub association, which is a typical plant community in shallow saline depressions throughout the Karakyr Uplands. The grass *Hordeum murinum* subsp. *leporinum* and the thistle *Onopordum leptolepis* are feature of the field layer beneath the 1-1.2m high tamarisk shrub canopy.

A total of 35 species were recorded by Beshko (2020) within the ephemeroid-Saltwort association (*Salsola orientalis*, *Carex pachystylis*, *Poa bulbosa*) on the studied site were recorded during the survey, with 12 species of aboriginal synanthropic weeds and no adventitious plants found. The camelthorn-tamarisk association (*Tamarix laxa*, *Alhagi pseudalhagi*, *Suaeda altissima*, *Climacoptera longistylosa*) supports 20 plant species, with no adventitious plants recorded.

The habitat surveys undertaken by AECOM ecologists during the November-December site visit confirmed the determination of the aforementioned habitat types which were identified by Beshko (2020).

Table 29. Assessment of habitats within the Solar PV Site (refer to footnotes)

Habitat	Description (CHA)[1]	Comments (AECOM)	PS6 Habitat Classification
Ephemeroid-Saltwort sub-shrub community	In the Soviet period, an unsuccessful attempt was made to develop agriculture, as seen from furrows and remains of a network of canals covering over 50% of the site area. Since last worked, 20—25 years ago, the vegetation has recovered and currently the territory is covered with ephemeral (fast-	The Solar PV Site is predominantly saltwort dominated xerophytic sub-shrub community. Historic ridge and furrow, irrigation channels and other disturbance is an obvious and ubiquitous feature of the Solar PV site. The results of the local community consultations confirmed that	Modified Habitat

	growing) plants typical of a disturbed environment. Aridity and strong grazing have resulted in a very low projective cover (10–20%). The vegetation is largely uniform, with low composition, and the only differences between various portions of the site are slightly varying levels of projective cover. Nearby residents use the area to pasture their livestock, with uncontrolled dumps of domestic and construction waste along the periphery of the site. Weeds are not abundant and do not play a significant part in the vegetation cover. No rare species included in the national or international Red Data Book were recorded during the field survey. No naturally occurring IUCN Red List or URDB threatened plant species were recorded during the field survey. Google Earth imagery for this habitat shows considerable evidence of disturbance, in the form of past cultivation and intersected by abundant pathways. The vegetation within the Solar PV site is classified as Modified Habitat within Table 1 of the Suntrace (2020) CHA report in terms of the PS6 habitat classification.	unsuccessful attempts were made to develop agriculture after the collapse of the Soviet Union; agriculture was then abandoned due to soil salination and land desertification, exacerbated by irrigation. The enhanced soil salinity resulted in a succession to the current saltwort vegetation that currently prevails within the site and throughout the Karakyr Uplands. The saltwort xerophytic sub-shrub community is assessed as Modified Habitat in term of PS6 criteria, for the reasons described above. This is consistent with the assessment made in the CHA (Suntrace, 2020).	
Saltwort sub-shrub-Poa community	The PS6[2] states that the level of anthropogenic impact should be determined with respect to the greater landscape. Although patches of virgin lands are noted within the Karakyr Uplands, the area is disturbed and small patches of natural habitat are not recognised as the ecological functions there are heavily disturbed. All habitats associated with the Solar PV AoI are modified habitats in accordance with the PS62. This finding is consistent with a statement within Beshko (2020) that the Surkhan-Sherabad valley is an ancient agricultural oasis that has been used by human beings for many centuries, with many human settlements (mainly villages) located in the area. All areas suitable for farming are used to cultivate crops or as gardens, causing most of the study area consists of anthropogenic landscapes (agro-landscapes, residential and industrial landscape).	Fragmented stands of a grassier vegetation type (*Poa bulbosa*), where the cover of Saltwort is reduced (thereby forming a mosaic with the prevailing aforementioned Saltwort dominated vegetation), occurs in fragmented areas where the signs of disturbance from cultivation (eg. ridge and furrow) is less visible. These areas are likely to represent older areas of cultivation and the habitat somewhat resemble a more natural arid rangeland (grass, forb and shrub) habitat type. These grassier patches are found in the eastern part of the Solar PV site, to the north of the cemetery and to the east of the minor road dissecting the site; as well as a shallow localised linear drainage channels. Although the patches of the Saltwort-Poa community are visible as patches of darker shading on aerial photographs, the boundaries of this vegetation are not clearly defined/visible during the observations made during field survey conditions; this is perhaps	Modified Habitat

	The vegetation (throughout the Solar PV site) is largely uniform, with low composition, and the only differences between various portions of the site are slightly varying levels of projective cover. The vegetation within the Solar PV site is classified as Modified Habitat within Table 1 of the Suntrace (2020) CHA report in terms of the PS6 habitat classification.	indicative of an ecotone (botanical gradational zone) rather than a sharply defined mosaic of distinctly different vegetation communities which are a clear expression of geospatial variations in terms of disturbance events (ie. cultivation). These localised and botanically impoverished habitat areas are fragmented within the prevailing intervening heavily disturbed landscape. As suggested in the CHA (Suntrace 2020) assessment, the ecological functions have been adversely impacted as a result of the soil salinisation and desertification processes in the immediate surroundings. Therefore, there is negligible potential for enhancement of this habitat in terms of developing ecological successional processes that would push the vegetation towards a natural (rather than modified) rangeland habitat that may resemble historical conditions (including prior to ancient agriculture within the Surkhan-Sherabad valley). The fragmented patches of the Saltwort-Poa community are assessed as Modified Habitat in term of PS6 criteria, for the reasons described above. This is consistent with the assessment made in the CHA (Suntrace 2020).	
Saltwort-Camelthorn-Tamarisk Shrub community (*Tamarix laxa, Alhagi pseudalhagi, Suaeda altissima, Climacoptera longistylosa*)	Refer to summary from Beshko (2020). The vegetation within the Solar PV site is classified as Modified Habitat within Table 1 of the Suntrace (2020) CHA report in terms of the PS6 habitat classification.	Associated with a saline depression, this shrub vegetation represents a small remnant on the eastern periphery of the Solar PV site. It is fragmented from other stands of similar habitat on the Karakyr Upland, with heavily modified xerohalophytic vegetation to the west and the intensively farmed agricultural plain to the east. The habitat is subject to intensive grazing by cattle and sheep. The ecological functions of this small, fragmented and heavily disturbed habitat have been modified by human induced soil salinisation processes exacerbated and the relative proximity of the existing irrigation channel running along the eastern boundary of the Solar PV site. The camelthorn-tamarisk shrub is assessed as Modified Habitat in terms of PS6 criteria, for the reasons described above. This is consistent with the assessment made in the CHA (Suntrace 2020). No naturally occurring IUCN Red List or URDB threatened plant species were recorded during the	Modified Habitat

		field survey within this vegetation community.	
Artemisia-Saltwort sub-shrub - Ephemeroid community	The vegetation community which occurs locally where there are steep slopes (escarpment adjacent to the western boundary of the Solar PV site boundary and localised drainage valleys) is not specifically referred to in Beshko (2020). However, this report mentions the presence of areas of degraded uncultivated lands within the Karakyr Uplands, however the over-riding description of the area is one of widespread disturbance.	The slopes which typify the escarpment along the western periphery of the Solar PV site are considered unlikely to be subject to historic cultivation and agricultural modification. The presence of perennial wormwood (Artemisia) is notable in this habitat; it appears to be absent from the aforementioned Saltwort sub-shrub/Saltwort sub-shrub-Poa communities which are the prevailing habitat of the flat plateau of the Solar PV site. This Artemisia community is perhaps a remnant of an Artemisia rangeland habitat that existed in the Karakyr upland prior to historic agricultural modification. A flowering plant listed in the Uzbekistan Red Book occurs in this vegetation community: *Chesneya tribuloides*. The` co-ordinates of the single plant recorded is: 37.524826, 66.851008.	Natural Habitat (degraded)

[1]Suntrace (2020). *Critical Habitat and Impact Assessment Report for Utility-Scale Solar Photovoltaic PPP Project in Sherabad District, Surkhandarya Region of the Republic of Uzbekistan*. Prepared for Asian Development Bank in August 2020.
[2] IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (revised June 2019)

In terms of the assessment against the PBF guidelines as set out in EBRD PR6 GN (refer to Appendix D), no habitat types or ecosystems were present or identified as being potentially present, that would be considered as priority habitats as such Criterion 1: Threatened Habitat has not been triggered. No higher or lower plant species were recorded which would be considered as Priority Biodiversity Features under PBF Criterion 2 (Vulnerable species).

A single plant species of conservation concern was recorded during the surveys: *Chesneya tribuloides*, a URDB listed species (refer to Table 26 above).No Invasive Non-native Species (INNS) were recorded during the baseline surveys.

Figure 6-17. Habitat at the centre of the Solar PV Site

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-18. Western side of the Solar PV site showing widespread historic agriculture (ridge and furrow plough-lines)

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-19. Saltwort xerophytic sub-shrub community to the east of the asphalt local access road dissecting the Solar PV site (Modified Habitat). Historic ridge and furrow and irrigation ditches evident in these areas.

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-20. Saltwort xerophytic sub-shrub community to the east of the asphalt local access road dissecting the Solar PV site (Modified Habitat). Irrigation ditches evident in these areas.

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-21. Saltwort shrub with historic irrigation canals dissecting a landscape disturbed by former cultivation (modified habitat). To the west of the asphalt local access road dissecting the Solar PV site

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-22. Saltwort-Poa association in winter. Occurs in localised areas where the signs of ridge and furrow and and historic irrigation are less distinct (indicative of older cultivation)[48]

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

[48] The vegetation is very similar to other modified habitat within the Solar PV site, with Salsola still a constant in the community but grass (Poa) and crustose lichen soil crust community achieve higher coverage

Figure 6-23. The localised Camelthorn- Tamarisk habitat is a saline depression on the eastern extremity of the Solar PV site

Source: GBI (2022) – Site visit photos April 2022

Figure 6-24. Saltwort-Poa association in spring. The habitats are subject to high levels of grazing and trampling.

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-25. The Artemisia-Saltwort sub-shrub - Poa community associated with the steep slopes at the escarpment (near western boundary of the Solar PV site) – Natural Habitat (Degraded)

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-26. Perennial Wormwood (*Artemisia*) is restricted to the Artemisia-Saltwort sub shrub – Ephemeroid community occurring on the steeper slopes which are undisturbed by historic cultivation. The plants are heavily grazed and subject to trampling damage by livestock.

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-27. *Chesneya tribuloides* (Uzbekistan Red Data Book species). Growing within the Artemisia-Saltwort sub-shrub - Poa community on the escarpment near the western boundary of the Solar PV

Source: GBI (2022) – Site visit photos April 2022

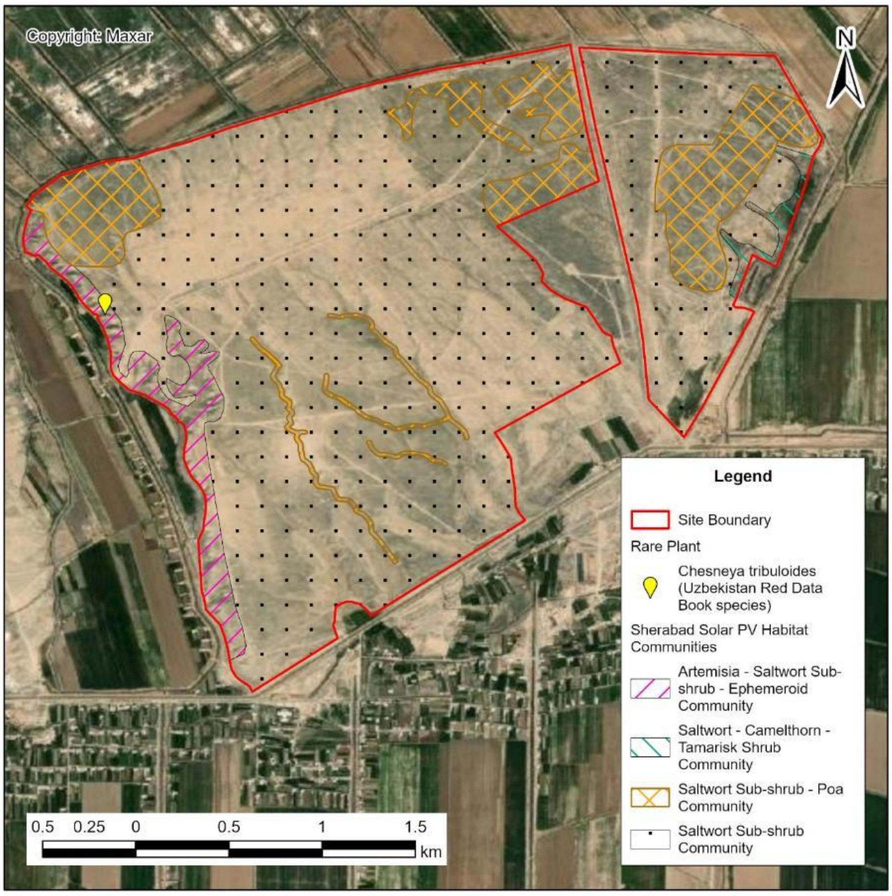

Figure 6-28. Map showing the Vegetation Communities within the Solar PV Site

6.5.10.2 Habitats - Overhead Line Route

Habitat and floral surveys were undertaken by Beshko (2020) in late winter/early spring: 6th-9th March 2020. The results of the surveys were ground-truthed by local botanical specialists during the AECOM baseline surveys which were undertaken in 1st-5th April 2022, which therefore coincided with the spring growth season. The following narrative provides a summary of the aforementioned ecological surveys.

The Overhead Line crosses intensive agro-landscapes along the majority its length (ie. approx. 30.7 km) and approx.18.5km of more natural landscapes which have been subject to some modification relating to anthropogenic activity, as follows: Shuratakum Gorge (4.6 km) and Khaudag Ridge/Kattakum Sands (13.9 km). Beshko (2020) consider that the Khaudag Ridge and the Kattakum sands as representing a single entity in terms of biodiversity and this area is referred to as 'the Khaudag' herein. The Governmental Technical Standard GOST 17.8.1.02-88 '*Nature protection. Landscapes. Classification*,' describes the aforementioned areas as being classified as being slightly or moderately transformed landscapes.

A classification of the aforementioned habitats against the ICF PS6 definitions (IFC, 2019), for each of the aforementioned habitat areas within the Overhead Line Right of Way (RoW), is provided within the Critical Habitat and Impact Assessment report (Suntrace, 2020). The results of this assessment has been compared to AECOM data detailed in Table 22.The habitats at the Shuratakum Gorge, Karasu River crossing and the Khaudag Ridge are shown in Figure 6-29 below, with a more detailed map showing the modified and natural habitat at Shuratakum Gorge shown on Figure 6-30 below.

No habitat types or ecosystems were present or identified as being potentially present for the Overhead Line that would be considered as priority habitats as such Criterion 1: Threatened Habitat (PBF guidelines as set out in EBRD PR6 GN) [refer to Appendix D: Critical Habitat Assessment Report [Turnstone Ecology, 2022)]

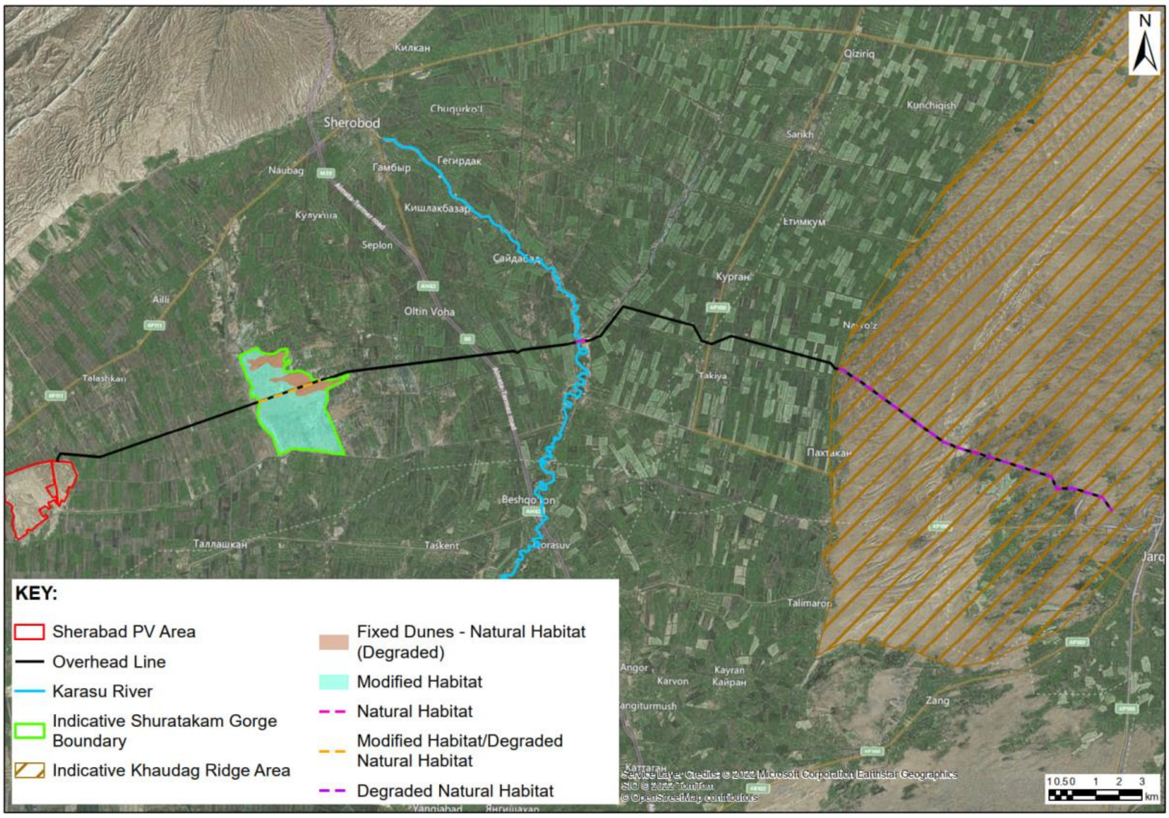

Figure 6-29. Habitats at the Shuratakum Gorge, Karasu River crossing and the Khaudag Ridge

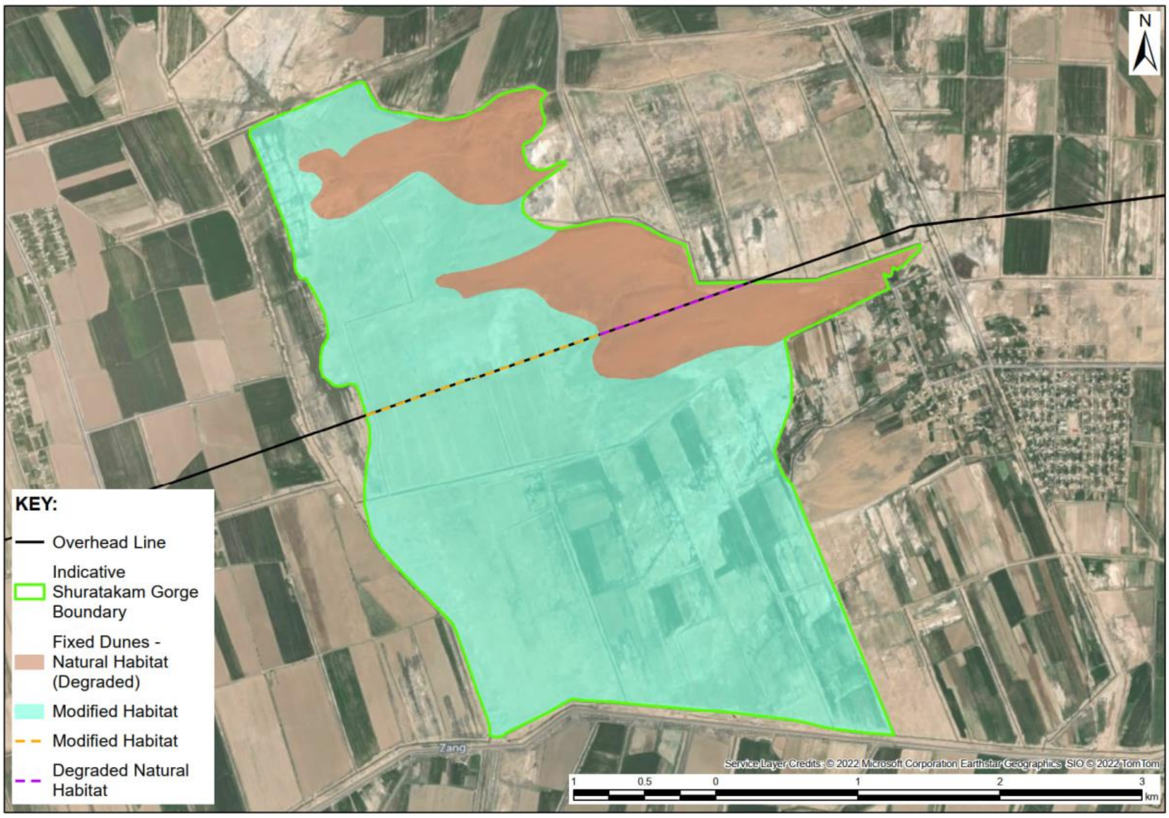

Figure 6-30. Habitats at the Shuratakum Gorge

Table 30. Assessment of habitats within the Overhead Line RoW

Habitat	Description	PS6 Habitat Classification
Agro-landscapes	The affected part of the shallow Sherabad valley features an anthropogenic landscape of cotton, wheat and alfalfa fields, orchards, vegetable gardens, tree lines, roads, networks of irrigation canals and villages. Beshko (2020)[1] states that there is a low diversity of plant species within the Sherabad valley, with a total of 48 plant species, including cultivated plants and synanthropic weeds. Secondary associations of ruderal and segetal weeds are very localised along roads, canals and field borders. No naturally occurring IUCN listed threatened species or RDB of Uzbekistan threatened plant species recorded during baseline field surveys.	Modified Habitat
Shuratakum Gorge	As noted by Beshko (2020)[1] and confirmed during the AECOM surveys, this sandy loam habitat is not suitable for agriculture, but actively used for livestock grazing. The habitats observed during the 2021/22 AECOM field surveys are a predominantly a patchwork of fields which have been subject to historic cultivation and irrigation (modified habitat). There are localised areas of fixed sand dunes which form a hill in the northern part (degraded natural habitat). Asphalt and dirt roads dissect the area and groundwater open collectors have been excavated. The vegetation is degraded as a result of overgrazing. This habitat area is in close proximity to Khtay village. The CHIA[2] classifies the habitat of the Shruratakum Gorge as Modified in terms of PS6 criteria. Although AECOM observed that Modified habitat is evident in the	Modified Habitat and Natural Habitat (degraded)

	areas where there are historic fields and plough-lines (with irrigation channels), the localised areas of raised fixed dunes (which are unlikely to have been subject to agricultural modification) are considered a better fit to a Natural Habitat which has been heavily degraded by overgrazing. No IUCN listed threatened species and/or URDB threatened plant species were recorded during field surveys of the Khaudag.	
Karasu River	Secondary associations of ruderal and segetal weeds occupy small areas along roads, canals and field borders. Riparian and halophytic (tamarisk, camelthorn, reed) associations were recorded fragmentarily on the floodplain of the Karasu River. The Karasu riverbank is rich with clay cliffs, which are places for nesting birds and habitat for many reptiles eg. saw-scaled viper. This habitat has been modified in some areas by mining for brick production, although the riparian habitat at the Overhead Line Karasu river crossing is considered to be a better fit to a degraded natural habitat rather than the modified habitat categorisation as detailed in the CHIA[2]. No IUCN listed threatened species and/or URDB threatened plant species were recorded during field surveys of the Khaudag.	Natural Habitat (degraded)
Khaudag	As detailed in Beshko (2020)[1], the Khaudag ridge is a low hill (553 m above sea level) with rare outcrops of the parent rock surrounded by the dune sand habitat of Kattakum. Habitats are generally natural landscapes degraded by grazing. Residents pasture their livestock and dispose of their rubbish here in an uncontrolled way. A small quarry pit exists at the existing power transmission line, providing raw material for a cement plant. Overgrazing is the main anthropogenic impact on the vegetation. Forty plant species were recorded, with 17 aboriginal weeds and a single adventitious plant – ruderal weed *Xanthium spinosum*. As detailed in Beshko (2020)[1], the vegetation forms a mosaic in relation to the spatial distribution of fixed sands and loose sand substrate. Plant associations include: • The bindweed-ephemeral-ephemeroid community (*Convolvulus hamadae*, *Carex pachystylis*, *Carex physodes*, *Poa bulbosa*, *Bromus tectorum*, *Hordeum murinum subsp. leporinum* and the psammophyte *Carex physodes*). • The Saltwort-bindweed-ephemeroid community (*Convolvulus hamadae*, *Salsola orientalis*, *Carex pachystylis*, *Carex physodes*, *Poa bulbosa*) associations, with small areas covered abundantly with camelthorn *(Alhagi kirghisorum*) and *Hulthemia persica*. There is no clear distinction (in terms of species structure and composition) between the aforementioned bindweed-ephemeral-ephemeroid and saltwort-bindweed-ephemeroid associations, with the exception in the relative proportions of *Salsola orientalis* and *Convolvulus hamadae*. • The ephemeral-ephemeroid-Calligonum community (*Calligonum microcarpum*, *Carex physodes*, *Poa bulbosa*, *Bromus tectorum*, *Hordeum murinum subsp. leporinum*). The shrub *Calligonum microcarpum* is a constant species forming a 50-100cm shrub canopy. • The ephemeral-bindweed-Calligonum (*Calligonum microcarpum*, *Convolvulus hamadae*, *Poa bulbosa*, *Bromus tectorum*, *Hordeum murinum subsp. leporinum*) associations are locally common. • Halophytes are abundant in the lower parts of the area at the foot of Khaudag and are represented by a Saltwort-tamarisk association, whose species composition, with occasional annual Saltworts, *Climacoptera* sp., *Salsola* sp., *Suaeda* sp.) or a general absence of vegetation in the most heavily salinised areas, such as the flat valley bottom solonchaks which occasionally intersect the Khaudag hill landscape. The desert pasture vegetation occurring on the higher elevations of the Khaudag is degraded by varying intensities of overgrazing, with Harmala-ephemeral-ephemeroid and Harmala-Saltwort-ephemeroid associations (*Peganum harmala*, *Salsola orientalis*, *Carex pachystylis*, *Poa bulbosa*, *Bromus tectorum* and *Hordeum murinum* subsp. *leporinum*). The xerophytic communities observed during the AECOM surveys included camel thorn (*Alhagi pseudoalhagi*), perennial saltworts (*Salsola*	Natural Habitat (degraded)

arbusculiformis), bindweed (*Convolvulus olgae*), forbs in the pea and poppy family (*Astralegus* sp.and *Hypecoum parviflorum*), broad-leaved grasses and Siberian lily (*Ixiolirion tataricum*). There are localised salt lakes (solanchaks) which support halophytic species such as *Salicornia* spp.

No IUCN listed threatened species and/or URDB threatened plant species were recorded during field surveys of the Khaudag.

1 Beshko, N. Yu. (2020). Evaluation of the Current State of the Flora and Vegetation in the Sherabad Solar IPP Project Territory – Annex 4 of the Critical Habitat Assessment Report (Suntrace, 2020)

[2]Critical Habitat and Impact Assessment report (Suntrace, 2020).

[3] Nazarov, R.A. (May 2022). A Report on Potentially Affected Reptiles at the Project site in the Sherabad Region.

Figure 6-31. Shuratakum Gorge. Fixed dune natural habitat in the foreground and modified historically irrigated/cultivated land in the background which is subject to anthropogenic disturbance eg. overgrazing and localised waste tipping

Source: Fazlullo Agzamov (2022) – Site visit photos April 2022

Figure 6-32. Karasu River and associated riparian amarisk shrub

Source: GBI (2022) – Site visit photos April 2022

Figure 6-33. Eastern side of Khaudag Ridge near the Surkhan Sub-station

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-34. The Khaudag in less disturbed area. The landscape consists of fixed, semi-fixed and loose sands (Kattakum) interspersed with saline depressions, with a row of hills (Khaudag) Overgrazing is the main anthropogenic impact on the vegetation.

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-35. Western part of Khaudag Ridge with transmission lines and salt-lake (solonchak)

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

Figure 6-36. Salt-lake (solonchak) on western part of Khaudag Ridge

Source: Stephen Dixon (2021) – Site visit photos November/December 2021

6.5.10.3 Birds

Ornithological surveys were undertaken for ADB by Ten et al. (2020) between 6th-13th March 2020 and reported in the Critical Habitat and Impact Assessment report (Suntrace, 2020). Two IUCN Red Listed threatened species that were recorded were potentially relevant to the AOI: eastern imperial eagle (VU) and Egyptian vulture (EN). The latter species was apparently recorded near the sub-station (Kattakum/Khaudag), however flight data is not available for this species at this location. The results of the Critical Habitat Assessment highlight the potential occurrence of small populations of a limited number of IUCN Red-listed EN bird species and does not trigger critical habitat in terms of IFC Performance Standard 6 (PS6).

The 2020 ADB bird surveys and AECOM 2022 bird surveys both coincided with the spring migration period and also the breeding season for summer migrants and resident species. The AECOM 2021 surveys were undertaken during the winter period when Eurasian wintering migrants and resident species occur. Further details of all ornithological surveys undertaken for the project, including the AECOM Asian Houbara surveys, are detailed in Sections 2.1.5.1 and 2.1.5.2 below.

ADB Survey Results (as reported in Suntrace 2020)

The most numerous species within the Solar PV Site was crested lark; greater short-toed lark and black-bellied sandgrouse were also recorded. The surveys also included flight activity surveys within the Solar PV site and also included the Overhead Line. The results of these surveys showed that the direction of movement of migratory birds during the spring passage period is predominantly northern. In terms of the resident vulture species listed on the Uzbekistan red List (cinerous vulture, Eurasian griffon and lammergeier) and the migratory Egyptian vulture (IUCN EN), landfills and carcass dumps in the Kattakum Sands region provide a potential food source for these scavenger species.

Details of the flight activity surveys are summarised in Table 31 below.

Table 31. Flight Activity for Species recorded at or adjacent to the Project Site by Suntrace between 6-13 March 2020 (refer to footnotes)

Date	Common name	IUCN threatened[1]?	URDB Listed[2]?	PBF (EBRD PR6 GN)	Number in one flock	Altitude (m)	Direction in °	Type of movement[1]	Location
06.03.2020	Eurasian Griffon	x	✓(VU)	✓	2	200	175	2	Kattakum sands near OHP TL
06.03.2020	Marsh Harrier	x	x	x	3	10		4	Kattakum sands near OHP TL
06.03.2020	Marsh Harrier	x	x	x	1	100		4	Agrolandscape
06.03.2020	Marsh Harrier	x	x	x	1	10		4	Karakyr upland -Solar PV site
06.03.2020	Lammergeier	x	✓(VU)	✓	1	50-75	270	2	Kattakum sands near OHP TL
06.03.2020	Raven	x	x	x	1	10		4	Kattakum sands near OHP TL
06.03.2020	Raven	x	x	x	1	40		4	Kattakum sands near OHP TL
06.03.2020	Black Kite	x	x	x	2	75		2	Kattakum sands
06.03.2020	Long-legged Buzzard	x	x	x	1	50		4	Karakyr upland -Solar PV site
06.03.2020	Eastern Imperial Eagle	✓(VU)	✓(VU)	✓	1	150		4	Shuratakum gorge

06.03.2020	Crested Lark	x	x	x	6	5-10		4	Kattakum sands near OHP TL
06.03.2020	Cinereous Vulture	x	✓(NT)	x	1	200	175	2	Kattakum sands near OHP TL
07.03.2020	Hen Harrier	x	x	x	1	7		2	Karakyr upland -Solar PV site
07.03.2020	Hen Harrier	x	x	x	1	7		2	Karakyr upland -Solar PV site
07.03.2020	Hen Harrier	x	x	x	1	5		2	Karakyr upland - Solar PV site
07.03.2020	Hen Harrier	x	x	x	1	3		2	Karakyr upland - Solar PV site
07.03.2020	Hen Harrier	x	x	x	1	3		2	Karakyr upland -Solar PV site
07.03.2020	Common Crane	x	x	x	20	100		1	Near IBA Amudarya floodlands
07.03.2020	Crested Lark	x	x	x	1	10		4	Karakyr upland - Solar PV site
07.03.2020	Crested Lark	x	x	x	1	10		4	Karakyr upland - Solar PV site
07.03.2020	Crested Lark	x	x	x	2	3		4	Karakyr upland -Solar PV site
09.03.2020	Hen Harrier	x	x	x	1	2		2	Kattakum sands near OHP TL

09.03.2020	Greylag Goose	x	x	x	11	50	0	1	Khaudag ridge - near OHP TL
11.03.2020	Common Crane	x	x	x	10	500	331	1	Karakyr upland – Solar PV site
12.03.2020	Black-bellied Sandgrouse	x	x	x	2	200	130	4	Karakyr upland - Solar PV site

Footnotes

[1] Globally threatened species (IUCN web site): CR – critical endangered, EN – endangered, VU – vulnerable

[2] Uzbekistan Red Data Book (2019): CR – critically endangered, EN – endangered, VU – vulnerable, NT – near threatened

Bird species were classified into High Risk, Medium Risk or Low Risk categories based on information in Oppel (2020)[49] and Rioux et al. (2013)[50]. Large raptors (vultures, eagles) and waterfowl (ducks, geese, cranes, cormorants) are assigned a 'High Risk' collision category. Medium-small sized raptors (buzzards, harriers, kites, hawks & falcons), crows and black-bellied sandgrouse are assigned Medium Risk collision category. Small perching birds are assigned a 'Low Risk' collision category.

An initial analysis of bird flight patterns reveals that a diverse range of high collision risk species is present within the region, however the number of flights across the Solar PV and OHP transmission line AoI is relatively low compared to flights recorded from areas which are remote form the AoI (ie. Amudarya Floodlands KBA (including Kampyrtepa) and the Kelif Sherobad Mountains[51].

The areas of highest sensitivity are avoided by the project. Data suggests that the majority of high and Medium collision risk species are flying at altitudes exceeding the maximum height of the overhead transmission line, which reduces the likelihood of collision with these structures. However, data was collected during one season and there is a data gap associated with the transmission line crossing of the River Karasu. Endangered birds do occur within this region, but local populations are unlikely to meet thresholds provided by the IFC Guidance Note 6 (GN6) (IFC, 2019).

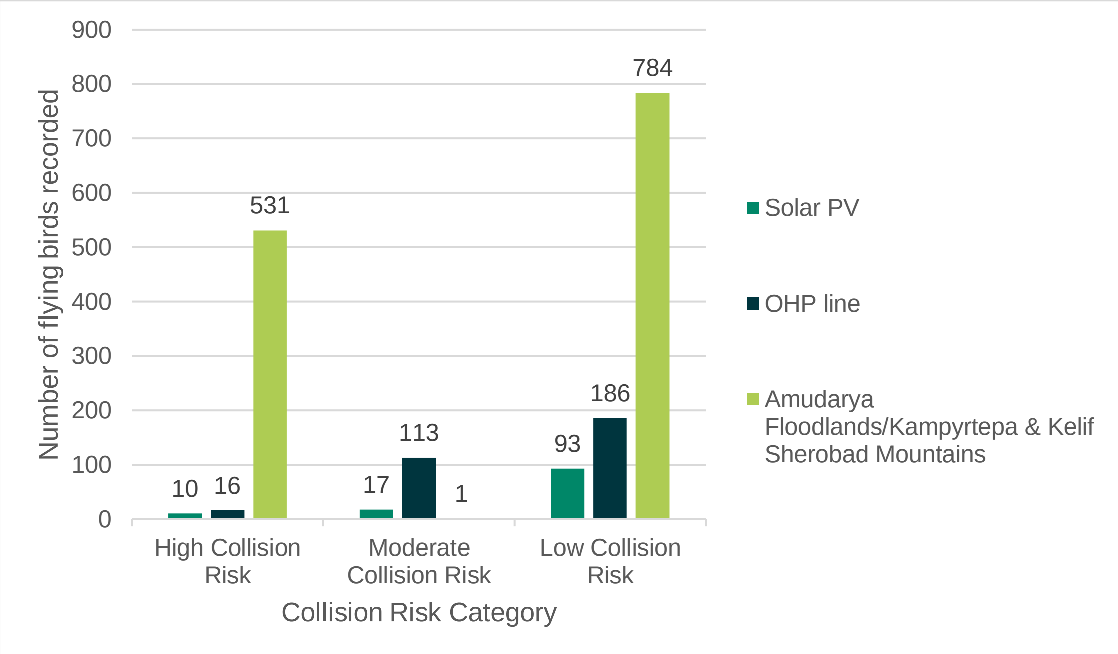

Figure 6-37. Number of Bird Flights Recorded during Suntrace March 2020 Surveys Per Species Collision Risk Category

Consultation with local residents by Suntrace suggest that common crane and demoiselle crane (High Risk collision species) do stop and rest on the Karakyr Upland (where the Solar PV is sited) during migration and wintering; Suntrace (2020) suggest that human disturbance and hunting are unlikely to make this area attractive for foraging and resting cranes. A notable record in March 2020 relates to a flock of 10 overflying common cranes at an altitude of 500m above the Solar PV site. Another notable finding from these consultations is the presence of little bustard in cultivated fields but the apparent absence of great Bustard and Asian houbara.

[49] Oppel, S. (2020). Reducing the risk of electricity infrastructure for biodiversity in Ethiopia. Briefing Document for World Bank, Ethiopian Electric Power and Ethiopian Electric Utility. January 2020. Addis Ababa.
[50] Rioux, S.Savard, J.P. and Gerick, A. (2013). Avian mortalities due to transmission line collisions: A review of current estimates and field methods with an emphasis on applications to the Canadian electric network. Avian Conservation and Ecology.8.10.5751/ACE-00614-080207
[51] The Amudarya Floodlands KBA (including Kampyrtepa) and the Kelif Sherobad Mountains are located within the 50km buffer from the Project Site and were therefore subject to the ecological surveys undertaken by Suntrace in March 2020.

Baseline Surveys undertaken by AECOM

The following IUCN threatened species were recorded by AECOM in low numbers: Egyptian vulture (IUCN [EN]) and eastern imperial eagle (IUCN [VU]).

The following Uzbekistan Red Listed species were recorded in low numbers: Egyptian vulture, cinerous vulture, Eurasian griffon vulture, little bustard, osprey and white stork.

The results of the AECOM bird surveys are detailed in Table 24 below.

Table 32. Summary of the Bird Species Recorded During the AECOM Surveys within the Project site (refer to footnotes)

Common Name	IUCN Threatened[1]	URDB Listed[2]	PBF (EBRD PR6 GN)	Peak Count												Comments
				Visit 1: Nov/Dec 2021				Visit 2: April 2022[3]				Visit 3: April 2022[4]				
				S	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	
Barn Swallow	x	x	x					40		20	32	9	27		18	
Black-bellied Sandgrouse	x	x	x	20				12		8		10			3	Possible br species wit Solar PV
Black-headed Gull	x	x	x					6								
Black Kite	x	x	x				1									
Black-throated Accentor	x	x	x			1										
Calandra Lark	x	x	x	100		20										
Carrion/Hooded Crow	x	x	x				2			1		5				
Chaffinch	x	x	x			20		7		4						
Cinereous Vulture	x	✓(NT)	x								1					1 carcass u power-line
Clamorous Reed Warbler	x	x	x							11	15					
Collared Dove	x	x	x					4		2	4	1				
Common Crane	x	x	x									20				Overflying
Common Buzzard	x	x	x												1	
Common Kestrel	x	x	x	1			2	2		1	1	2	1		1	
Common Pheasant	x	x	x										1			
Common Ringed Plover	x	x	x										1			

Common Name	IUCN Threatened[1]	URDB Listed[2]	PBF (EBRD PR6 GN)	Peak Count												Comments
				Visit 1: Nov/Dec 2021				Visit 2: April 2022[3]				Visit 3: April 2022[4]				
				S	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	
Common Starling	x	x	x				25									
Common Swift	x	x	x					5		5	7	7				
Corn Bunting	x	x	x			1										
Crested Lark	x	x	x	20		10	2	21		6	14	15	45		24	Probable breeding w the Solar P
Desert Finch	x	x	x										1			
Eastern Imperial Eagle	✓(VU)	✓(VU)	✓	1											1	overflying
Eastern Orphean Warbler	x	x	x										7			
Egyptian Nightjar	x	x	x									3				Confirmed breeding. 3 singing ma present
Egyptian Vulture	✓(EN)	✓(VU)	✓								3	1	2		4	
Eurasian Eagle Owl	x	x	x							1						
Eurasian Griffon Vulture		✓(VU)	✓								1					1 carcass u power-line
Eurasian Sparrowhawk	x	x	x												1	
Feral Pigeon	x	x	x					44		28	66	30	11		8	
Finsch's Wheatear	x	x	x					1		3	2					
Great White Egret	x	x	x	1								1				overflying
Green Sandpiper	x	x	x			2				2	5					
Grey Heron	x	x	x	1				1				1				
Hen Harrier	x	x	x	1			2				1	1	1			
Hoopoe	x	x	x					2		1	1	1	1			
Indian Myna	x	x	x					8		12	5	5				

Common Name	IUCN Threatened[1]	URDB Listed[2]	PBF (EBRD PR6 GN)	Peak Count												Comments
				Visit 1: Nov/Dec 2021				Visit 2: April 2022[3]				Visit 3: April 2022[4]				
				S	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	
Isabelline Wheatear	x	x	x					3		2	3		1			Possible br species wit Solar PV
Kingfisher	x	x	x			1										
Laughing Dove	x	x	x					5		3						
Lesser Whitethroat	x	x	x							3						
Little Bustard	x	✓(VU)	✓												1	Probable si (footprints/c ngs) found Khaudag
Little Owl	x	x	x	1		1		1		1						
Long-legged Buzzard	x	x	x	1			1	2			1	1	1			
Magpie	x	x	x					6		4	3		4			
Marsh Harrier	x	x	x	1				3		2	5	1	3		2	Confirmed nesting at Khaudag a lake
Montagu's Harrier	x	x	x												1	
Northern Goshawk	x	x	x									1				
Osprey	x	✓	x							1			1			
Peregrine	x	x	x				1									
Pied Stonechat	x	x	x					1		2						
Pied Wheatear	x	x	x										1			
Quail	x	x	x										1			
Raven	x	x	x				7	2		2	3	1	4		1	
Reed Bunting	x	x	x	1												
Rook	x	x	x					5		2	2					
Sand Martin	x	x	x										2			
Short-toed Eagle	x	x	x												1	

Common Name	IUCN Threatened[1]	URDB Listed[2]	PBF (EBRD PR6 GN)	Peak Count												Comments
				Visit 1: Nov/Dec 2021				Visit 2: April 2022[3]				Visit 3: April 2022[4]				
				S	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	*S*	*Sh*	*Ka*	*Kh*	
Skylark	x	x	x				10									
Siberian Stonechat	x	x	x					1		2			1			
Spanish Sparrow	x	x	x			100		6		15	3		53			
Tawny Pipit	x	x	x	1											1	
Tree Pipit	x	x	x					4		15	2					
Wallcreeper	x	x	x	1		1										
Water Rail	x	x	x			2										
White Stork	x	✓(NT)	x							1						
Yellow Wagtail	x	x	x							2		26	12		3	

Footnotes

Footnotes

[1] Globally threatened species (IUCN web site): CR – critical endangered, EN – endangered, VU – vulnerable

[2] Uzbekistan Red Data Book (2019): CR – critically endangered, EN – endangered, VU – vulnerable, NT – near threatened species

[3] Species recorded during the ESIA ecology surveys undertaken between 2nd- 4th April 2022

[4] Species recorded incidentally during the Asian Houbara surveys undertaken between 6th-9th April 2022

S = Solar PV site

Sh = Shuratakum Gorge, *Ka* = Karasu River Crossing, *Kh* = Khaudag Ridge (respective key areas relevant to the Overhead Line route)

6.5.10.4 Mammals

The following mammal species were confirmed to be present within the Solar PV site during the 2020 Suntrace surveys and the AECOM baseline surveys undertaken in 2021 and 2022 (none of which are IUCN threatened species or included within Red Data Book [RDB] of Uzbekistan): Zaisan mole vole (*Ellobius tancrei*), great gerbil (*Rhombomys opimus*), small five-toed jerboa (*Allactaga elater*), Libyan jird (*Meriones libycus*), yellow ground squirrel (*Spermophilus fulvus*), long-eared Hedgehog (*Hemiechinus auratus*), Tolai Hare (*Lepus tolai*) and red fox (*Vulpes vulpes*). Interviews with local residents suggest that jackal (*Canis aureus*) and wolf (*Canis lupus*) may occur. A single bat species (common pipistrelle [*Pipistrellus pipistrellus*]) was recorded over-flying the Solar PV site during a nocturnal survey. There is no habitat suitable for roosting within the Solar PV site and it is considered likely that bats are utilizing the farm buildings adjacent to the Solar PV site for roosting.

The following species were recorded during the AECOM baseline surveys in 2022 at the Karasu River Overhead Line crossing: golden jackel (*Canis aureus*), Brandt's hedgehog (*Paraechinus hypomelas*). The latter species is listed in the Red Data Book of Uzbekistan.

The Project site is located within the distribution range of the following mammals of conservation concern.

Marbled Polecat (*Vormela peregusna*)

Listed as Vulnerable (VU) by the IUCN and included in the Red Data Book of Uzbekistan (VU:D), this species is threatened by habitat destruction and degradation (eg. overgrazing) and widespread use of pesticides and rodenticides. Marbled polecat is a rare species which occurs in the central Asian ecoregion which includes the Surkhandarya region of Uzbekistan. Interviews with local residents during the April 2022 baseline surveys suggest that this species may occur within the Project site.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during the baseline surveys undertaken for the project.

Steppe Polecat (*Mustela eversmanii*)

Listed as Least Concern by the IUCN but is included in the Red Data Book of Uzbekistan, the species is threatened by habitat destruction and widespread use of pesticides and rodenticides. Known to inhabit a range of desert and semi-desert habitats across Central Asia. No evidence was recorded during the baseline surveys undertaken for the project surveys.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during the baseline surveys undertaken for the project.

Goitered Gazelle (*Gazella subgutturosa*)

Listed as Vulnerable by the IUCN, the species is threatened by illegal hunting and habitat loss (agricultural conversion and increasing domestic livestock numbers). This species is known to inhabit a range of desert and semi-desert habitats across Central Asia. No evidence was recorded during site surveys.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during the baseline surveys undertaken for the project.

6.5.10.5 Reptiles

Species of Conservation Concern

Tajikistan (Sogdian) Toadhead Agama (Phrynocephalus sogdianus)

As detailed in the CHA (Appendix D), Tajikistan toadhead agama is listed as IUCN Endangered but not included in the Uzbek Red Data Book. Due to its limited EOO (less than 50,000km2), it is considered as Range-Restricted. Therefore, this species is assessed against PS6 Criterion 1 and 2, and PR6 Criterion ii and iii within the aforementioned CHA.

Tajikistan toadhead agama is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands. None were recorded in or around the Solar PV Site and habitats in this area are considered unsuitable. However, up to 30 individuals were found in sand dune/semi-fixed sand habitat in the vicinity of the Overhead Line route at the Khaudag Ridge during reptile surveys completed in April 2022. Habitats within the Overhead Line route in the Khaudag Ridge area are considered suitable for this species and are contiguous to the area where individuals were recorded in 2022. The EAAA used in the CHA has therefore been determined to include areas of suitable habitat that are likely contiguous with the Overhead Line route which are not separated or modified by agriculture or urbanisation; it is calculated to be 250km2.

There are no population estimates available for this species either within Uzbekistan or an estimated population figure across its range and, as such, Global Range and size of EAAA were used in the CHA as a proxy for meeting the thresholds for CH under IFC Criterion 1 and Criterion 2, and EBRD Criterion ii and iii which are:

• Areas that regularly hold ≥0.5% of the global population size AND ≥5 reproductive units of a species. In absence of population data the area of the EAAA for this species has been assessed against the known global range of this species.

• The EAAA makes up 0.83% of the global range of this species and with 30 individuals recorded during surveys immediately adjacent to site it is therefore concluded that CH has been triggered under IFC Criterion 1 and EBRD Criterion ii for Tajikistan toadhead agama. CH under IFC Criterion 2/EBRD Criterion iii is not triggered on account of not more than 10% of population and 10 reproductive units not being exceeded.

Smooth Even-fingered Gecko (Alsophylax laevis)

The CHA undertaken by Turnstone Ecology (2022) [refer to Appendix D] assessed this species against IFC Criterion 1 and EBRD Crtiterion ii, as this is an IUCN Critically Endangered species. However the threshold for CH was not met and assessed it is likley the threshold would not be met if future surveys show that this species is present on the Project Site. According to Showler (2018)[52] this species is endemic to Uzbekistan and S/SW Turkmenistan. The distribution maps in Suntrace (2020) show the currently known core area for this species located in the northern and central Kyzylkum in northern Bukhara province and Navoi province. '*Much further south, it has been recorded at one locality in southern Surkhandarya approximately 15km NE of Termez city near the Surkhan Darya river at the following very approximate geographic coordinates: 37º21'N 67º27'E. In Surkhandarya (this species) inhabits takyr habitat in the sand desert zone at estimated elevations of 152m to 190m*' (Showler, 2018). The aforementioned location, to the east of the Surkhan Darya river, is approximately 19km to the SSE of the Project AOI at its closest point at the Surkhan substation; this location is therefore remote from the Project site.

Surveys completed to inform the ESIA did not record this species within the Project AoI and even if future surveys record this species within the Project site it is unlikely that CH would be triggered, however this species is a PBF species, and No Net Loss of this feature would need to be demonstrated. The species is considered more likely to occur within the riparian habitat at the Karasu river valley crossing, which is relevant to the Overhead Line element of the project.

Other Reptile Species

In terms of other reptile species which occur or potentially occur within 50km of the Project Site (including the AoI), the Critical Habitat Assessment (Suntrace (2020) confirms that these do not trigger critical habitat in terms of IFC Performance Standard 6 (PS6). This is also confirmed by the CHA undertaken by Turnstone Ecology (refer to Appendix D), however a number of species, which meet the critieria for inclusion as Priority Diversity Features when assessed against the PBF guidelines as set out in in EBRD PR6 GN, were recorded as detailed below.

Other reptile species of international and/or national conservation concern which are known to occur or likely to occur within the Solar PV and Overhead Line route (Abduraupov [2020], Nazarov [2022] are as follows:

- Central Asian tortoise (*Testudo horsfieldii*) – IUCN (VU), RDB of Uzbekistan (VU); The species is a PBF;
- Black-ocellated racerunner (*Eremias nigrocellata*) IUCN (LC), RDB of Uzbekistan (VU); The species is a PBF;

[52] Showler, D.A. (2018). A Checklist of the Amphibians and Reptiles of the Republic of Uzbekistan with a review and summary of species distribution. September 2018. Available at: https://www.sustainablehoubaramanagement.org/wp-content/uploads/2018/09/Uzbekistan-Amphibian-Reptile-Checklist-14Sept2018-PDF.pdf

- Transcaspian desert monitor - (*Varanus griseus caspius*) IUCN (LC), RDB of Uzbekistan (VU); The species is a PBF;
- Central Asian cobra (*Naja oxiana*) – RDB of Uzbekistan (NT);
- Indian gamma snake (*Boiga trigonata melanocephala*) IUCN (LC), RDB of Uzbekistan (VU); The species is a PBF;
- Afghan awl-headed snake (*Lytorhynchus ridgewayi*) IUCN (LC), RDB of Uzbekistan (VU); The species is a PBF;
- Boettger Caspian toad-headed agama *(Phyrynocephalus raddei boettgeri*) IUCN (LC), RDB of Uzbekistan (VU); The species is a PBF;
- Northern barred wolf snake (*Lycodon striatus bicolor*) IUCN (LC), RDB of Uzbekistan (VU) and; The species is a PBF;
- Tatar sand boa *(Eryx tataricus*) IUCN (Not Listed), RDB of Uzbekistan (NT). The species is a PBF;

The Overhead Line line crosses the Kattakum Sands/Khaudag desert habitat; this region supports a diverse assemblage of psammophilous species.

Baseline Survey Results (April 2022)

A summary of the reptile surveys undertaken in April 2022, as reported in Nazarov (2022), is provided in Table 25 and the narrative below. A total of 417 individuals of 17 reptile species were recorded during the baseline reptile surveys in April 2022. The surveys did not record smooth-even-fingered gecko. Information provided by Abduraupov (2020) is also detailed in Table 25 where relevant, within the purpose of providing further context in terms of the reptile baseline data which is applicable the Project site.

The following species of conservation concern were recorded within the Solar PV site: Central Asian tortoise (IUCN VU, URDB VU), black-ocellated racerunner (URDB VU) and tatar sand boa (URDB NT). The following species of conservation concern were recorded during the surveys for the Overhead Line route at the Khuadag Ridge: Tajikistantoad-head agama (IUCN EN) and tatar sand boa (URDB NT).

The following PBF species of conservation concern, were not recorded during the AECOM 2022 surveys, however these species are reported in Nazarov (2022) as being previously recorded by the author within the locality of the Overhead Line at the Khaudag Ridge: Transcaspian desert monitor, Boettger Caspian toad-head agama, Central Asian cobra and Indian gamma snake.

Table 33. Summary of Reptile Species Recorded within the Project Site during the AECOM surveys (refer to footnotes)

Species	Conservation Status			Location[3]			Comment
	IUCN Threatened Species[1]?	URDB[2]?	PBF (EBRD PR6 GN)	Solar PV (Karakyr Upland)	Kerasu River Crossing (OHTL)	Khaudag (OHTL)	
Central Asian tortoise (*Testudo horsfieldii*)	✓(VU)	✓(VU)	✓	✓[V1,V2]	x	x	Rare in the Karakyr Upland. 7 individuals per hectare in Kattakum desert (Abduraupov, 2020[4]). A single individual (female) was recorded within the Solar PV site on both of the April 2022 survey visits (Nazarov, 2022)[5]. Based on the results of the surveys and interviews with local residents, Nazarov suggests tortoises are very rare and that the habitats with the Solar PV site are unfavourable in terms of the supporting a sustainable population for this species. Therefore, the population density of tortoises within the Solar PV site is assessed as very low.
Comb-toed gecko (*Crossobamon eversmanni*)	x	x	x	x	x	✓[V1]	This species inhabits only weakly fixed, semi-fixed sands. It is known to occur Kattakum sands near the Khaudag (Abduraupov, 2020[4]). Thirteen individuals were recorded at the Khaudag Ridge near the OHTL during nocturnal surveys (Nazarov, 2022)[5.]
Bogdanov's bent-toed gecko (*Tenuidactylus bogdanovi*)	x	x	x	✓[V1]	x	x	Low population density within the Solar PV site (,0.1 individuals/ha), with 4 individuals recorded (Nazarov, 2022)[5].
Caspian Bent-toed Gecko (*Tenuidactylus caspius*)	x	x	x	✓[V1]	x	x	A low population density within the Solar PV site (<0.1 individuals/ha) and restricted to the slopes of the western escarpment (Nazarov, 2022)[5].
Turkestan plate-tailed gecko (*Teratoscincus scincus*)	x	x	x	x	x	✓[V2]	A sand dune specialist that has been recorded in Kattakum, near Khaudag (Abduraupov, 2020)[4]. Six individuals were recorded at the Khaudag Ridge near the OHTL during nocturnal surveys (Nazarov, 2022)[5].
Steppe agama (*Trapelus sanguinolentus*)	x	x	x	✓[V1]	x	✓[V2]	A common species within the Project site, occurring at low density (<1 individuals/ha). Five individuals were recorded within the Solar PV. A peak count of six individuals were recorded at the Khaudag Ridge near the OHTL (Nazarov, 2022)[5].

Species	Conservation Status			Location[3]			Comment
	IUCN Threatened Species[1]?	URDB[2]?	PBF (EBRD PR6 GN)	Solar PV (Karakyr Upland)	Kerasu River Crossing (OHTL)	Khaudag (OHTL)	
Sogdian toad-headed agama (*Phrynocephalus sogdianus*)	✓(EN)	x	✓	x	x	✓[V2]	This sand dune and semi-fixed dune specialist is endemic to south-eastern Uzbekistan and south-western Tajikistan and, in Uzbekistan, lives only in the south of Surkhandarya region (Abduraupov, 2020[4]). Counts of 30 and 10 individuals were recorded at the different areas at the Khaudag Ridge, immediately adjacent to the OHTL during the 22nd-26th April 2022 surveys undertaken by AECOM (Nazarov, 2022)[5].
Frilled toad-headed agama (*Phrynocephalus mystaceus*)	x	x	x	x	x	✓[V2]	Six individuals were recorded at the Khaudag Ridge near the OHTL (Nazarov, 2022)[5].
Black-ocellated racerunner (*Eremias nigrocellata*)	x	✓(VU)	✓	✓[V1,V2]	x	x	A fairly common and widespread species of reptile within the project area; Khaudag, Kattakum Sands and Karakyr Upland (Abduraupov, 2020[4]). The estimated population density within the Solar PV site is >3.5 individuals/ha (Nazarov 2022)[2].
Rapid Racerunner (*Eremias velox*)	x	x	x	✓[V1]	x	x	Common species within the Solar PV site (Nazarov 2022)[2].
Reticulate racerunner (*Eremias grammica*)	x	x	x	x.	x	✓[V2]	Six individuals were recorded at the Khaudag Ridge near the OHTL (Nazarov, 2022)[5].
Sand racerunner (*Eremias scripta lasdini*)	x	x	x	x	x	✓[V2]	This sand dune and semi-fixed dune specialist was recorded at Kattakum (Abduraupov, 2020[1]). A peak count of 15 individuals were recorded at the Khaudag Ridge near the OHTL (Nazarov, 2022)[5]. *E. s. pherganensis* endemic to the Fergana Valley was recorded as present and therefore assessed in the Critical Habitat and Impact Assessment, however this species is endemic to the Fergana Valley in NE Uzbekistan (Showler, 2018). It is therefore likely that that the records refer to sub-species *lasdini* and not *pherganensis*. (Abduraupov 2020, recorded *lasdini* only). Therefore, *E.s. pherganensis* is considered no further in is assessment

Species	Conservation Status			Location[3]			Comment
	IUCN Threatened Species[1]?	URDB[2]?	PBF (EBRD PR6 GN)	Solar PV (Karakyr Upland)	Kerasu River Crossing (OHTL)	Khaudag (OHTL)	
Striped racerunner (*Eremias lineolata*)	x	x	x	x	x	✓V2	A peak count of five individuals were recorded at the Khaudag Ridge near the OHTL (Nazarov, 2022)[5].
Saw-scaled viper (*Echis carinatus*)	x	x	x	x	✓V2	x	Recorded at Kerasu river crossing (Nazarov, 2022)[5].
Tatar sand boa (*Eryx tataricus*)	x	NT	✓	✓V1 V2	x	✓V2	Recorded at Kattakum near Khaudag and the Solar PV site in the Karakyr Upland (Abduraupov, 2020[4]). Nazarov (2022)[5] recorded a male and a female during nocturnal surveys within the Solar PV site. Individuals were also recorded at the Khaudag Ridge near the OHTL in two different locations during nocturnal surveys.
Sand racer (*Psammophis lineolatus*)	x	x	x	✓V1	x	x	A common and widely distributed species of snake within the Project site, with a single specimen observed in the NW part of the Solar PV site (Nazarov, 2022)[5].
Spotted desert racer (*Platyceps karelinii*)	x	x	x	x	x	✓V2	Recorded at the Khaudag Ridge near the OHTL (Nazarov, 2022)[5].

Footnotes

[1] Globally threatened species (IUCN web site): CR – critical endangered, EN – endangered, VU – vulnerable

[2] Uzbekistan Red Data Book (2019): CR – critically endangered, EN – endangered, VU – vulnerable, NT – near threatened species

[3] V1 = 1-5th April 2022 AECOM Reptile Survey Visit undertaken by R.A. Nazarov; V2 = 22nd-26th April 2022 AECOM Reptile Survey Visit undertaken by R.A. Nazarov

[4] Abduraupov, T.V. (2020). Evaluation of the Current State of Reptiles in the Sherabad Solar IPP Project Territory – Annex 5 of the Critical Habitat and Assessment Report (Suntrace, 2020).

[5] Nazarov, R.A. (May 2022). A Report on Potentially Affected Reptiles at the Project site in the Sherabad Region.

Figure 6-38. General view of a biotope within Solar PV and Black-ocellated Racerunner (URDB VU) in situ

Source: R.A Nazarov (2022) – Site visit photos April 2022

Figure 6-39. Karasu River at the Intersection of the Overhead Line – possible habitat of Smooth Even-fingered Gecko (IUCN CR) and Saw-scaled Viper in situ

Source: R.A Nazarov (2022) – Site visit photos April 2022

Figure 6-40. Western edge of Khaudag Range along Overhead Line - Sand Dunes and Tajikistan Toad-head Agama (IUCN EN) in situ

Source: R.A Nazarov (2022) – Site visit photos April 2022

6.6 Archaeology and Cultural Heritage

6.6.1 Overview

The Project is located in the Sherabad District of Surkhan-Darya province, and the proposed Transmission Line will traverse Sherabad, Kizirik and Dzharkurgan districts. The existing Surkhan substation is located in the Dzharkurgan district.

The Project is located east of the eastern foothills of the Kugitang mountain range and the Transmission Line crosses the low-lying landscape of the Sherabad plain, characterised by extensive irrigation channels, canals and agriculture. Some areas of the Solar Array site have been subject to previous ploughing. No archaeological or cultural heritage sites are currently known from within the Project footprint. There is extensive evidence for prehistoric, protohistoric and early medieval settlement and cultivation in the Sherabad Oasis, including sites in the vicinity of the transmission line.

The Surkhan-Darya region and northern Bactria is particularly significant in the Bronze Age, Early Iron Age and Kushan periods. The area had long-distance contacts, connecting to Bactra in Afghanistan via Termez and to Sogdian centres via the 'Iron Gate' pass to the north at Derbent.

This ESIA presents the cultural heritage legislation and policy context and baseline information regarding the Site and study area based on desk-based research including the State Register of Tangible Cultural Heritage Properties and a review of Google Earth satellite imagery.

6.6.2 Approach to Assessment

6.6.2.1 Scope

The scope of the archaeology and cultural heritage baseline studies follows the definition set out in EBRD and IFC cultural heritage policy and guidance.

EBRD PR8 defines cultural heritage "as a group of resources inherited from the past which people identify, independently of ownership, as a reflection and expression of their evolving values, beliefs, knowledge and traditions. It encompasses tangible (physical) and intangible cultural heritage, which is recognised at the local, regional or national level, or within the international community. Its scope includes:

- Physical cultural heritage refers to movable or immovable objects, sites, groups of structures as well as cultural or sacred spaces associated therewith, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance.
- Intangible cultural heritage refers to practices, representations, expressions, knowledge and skills that communities, groups and, in some cases, individuals recognise as part of their cultural heritage and which are transmitted from generation to generation." (EBRD 2019).

IFC Performance Standard 8: Cultural Heritage (IFC 2012) aims to protect cultural heritage from the adverse impacts of project activities and support its preservation. 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 and rocks.
- Intangible forms of culture proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.
- Critical Cultural Heritage, internationally recognised 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.

The baseline study considers palaeontological sites and archaeological and cultural heritage sites ranging in date from the prehistoric to the modern period, and considers both tangible and intangible heritage.

6.6.2.2 Study Area

The methodology for the archaeology and cultural heritage baseline assessment was based on identifying the Project Area of Influence (AoI), conducting a desk-top literature review and assessing the sensitivities of potential archaeological and cultural heritage sites.

The PAI is defined as a 50m buffer around the Solar Project including the solar PV plant, new substation, common facilities and a 200m buffer around the Transmission Line ROW centre line.

The desk-based Study Area for cultural heritage considers known archaeology and cultural heritage receptors in the wider area in order to provide context and to understand archaeological potential. It includes:

- The Project location plus a 1km buffer area around it, in order to identify heritage assets in the immediate vicinity of the Project, including surface find scatters, that may be vulnerable to the physical impact of project activities.
- Designated heritage assets (World Heritage properties, elements inscribed on the Representative List of the Intangible Cultural Heritage of Humanity, cultural heritage properties listed on the State Register, historical and cultural reserves, museum reserves) within 5km of the Project location, to provide context and assess Project impacts on their setting and visual amenity.
- Visually prominent, designated heritage assets between 5km and 15km from the Project location, depending on backdrop, visual contrast and viewing geometry in relation to the solar PV plant, Transmission Line and cleared ROW, to provide context and assess Project impacts on their setting.

Viewshed or visibility analysis has not been undertaken at this stage to determine the Project Zone of Theoretical Visibility (ZTV).

6.6.3 Desktop Study Methodology

The aim of the desktop study is to determine, as far as is reasonably possible from existing records, the nature, extent and significance of the archaeology and cultural heritage within the Study Area. The desktop study describes the historical development of the Study Area and the wider area, placing it in context in order to predict its archaeological and cultural heritage potential; anticipate the type, date, and character of remains; and broadly indicate areas with higher archaeological potential based on factors such as geology, topography, past and present land use, known archaeological remains and vegetation cover.

Sources consulted include:

- The National List of Tangible Cultural Heritage Properties (State Register of Monuments) for Surkhandarya Region – Dzharkurgan, Kizirik and Sherabad Districts[53];
- Historical and modern topographic mapping, including U.S. Army Map Service Series N502[54] and US Defense Mapping Agency Series 1501 Air mapping[55] and Soviet 1:100,000 scale Military Topographic Mapping[56];
- GoogleEarth Pro satellite imagery dated from 1985 to 2021. CORONA satellite imagery is not yet readily available in the Arkansas University *CORONA Atlas of the Middle East*[57] and strips have not been acquired as the data has been reviewed by previous archaeological researchers[58]; and
- Relevant regional and period archaeological and landscape studies, dissertations and readily available historical articles.

6.6.4 Archaeological Field Evaluation (State Expertise)

The Site has not been subject to previous archaeological investigation. The Site was subject to formal State Historical-Cultural Expertise of the Site by the Scientific Methodology Council under the Main Scientific Production Administration for Protection and Use of the Cultural Heritage Items of the Ministry of Culture of the Republic of Uzbekistan as part of the national OVOS EIA process. The State Historical-Cultural Expertise of the Site has been completed and the OVOS granted.

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[53] Cabinet of Ministers Resolution No. 846 "On the Approval of the National List of Tangible Cultural Heritage Properties" (October 4, 2019). Available at: https://lex.uz/docs/-4543266 Accessed 26 October 2021.
[54] 1952 Termez, Sheet NJ 42-9. Scale: 1:250,000. Western Siberia Series N502, U.S. Army Map Service. Available at: http://maps.lib.utexas.edu/maps/ams/western_siberia/txu-oclc-6559336-nj42-9.jpg
[55] 19551986/1992 Termez, Uzbekistan, Sheet NJ 42-9. Scale 1:250,000. US Defense Mapping Agency Hydrographic/Topographic Centre, Washington. Series N502. Available at: https://maps.lib.utexas.edu/maps/jog/russia/txu-oclc-224096234-nj42-09.jpg
[56] Soviet military topographic map sheets J42-086 (surveyed 1974, printed 1980) and J42-087 (surveyed 1975-1985, printed 1988). Scale: 1:100 000. Available at: MapStor.com
[57] https://corona.cast.uark.edu/
[58] Stančo, L & Tušlov, P. (eds.) (2019) Sherabad Oasis: Tracing Historical Landscape in Southern Uzbekistan. Reports of Czech-Uzbekistani Archaeological Mission in southern Uzbekistan Volume 2. Karolinum Press, Prague

6.6.5 Stakeholder Consultation

Consultation has been undertaken to obtain information on known archaeological and cultural heritage sites, including the State Register and the national digital inventory of objects of cultural and archaeological heritage created pursuant to Presidential Decree No. R-5181 (16 January 2018). Advice has been sought regarding the organisation of:

- State expertise (field reconnaissance survey, historical and cultural examination of archaeological heritage sites);
- Fieldwork permitting and open list procedures; and
- Chance find procedures and on-call archaeologists.

Consultation has been undertaken with:

- Agency for the Protection of Cultural Heritage of Uzbekistan under the Ministry of Tourism and Sports (Formerly the Ministry of Culture of the Republic of Uzbekistan, Department of Cultural Heritage);
- National Centre for Archaeology (Institute of History, Archaeology and Ethnography), Uzbek Academy of Sciences; and
- Competent regional and local authorities for protection and use of cultural and historical heritage objects [khokimiyats of regions].

6.6.6 Cultural Heritage Baseline Context

Due to the poor georeferencing of archaeological sites noted in the State Registers of Tangible Cultural Heritage for Surkhandarya Province, Regions of Dzharkurgan, Kizirik and Sherabad, it has not proved possible to correlate them with sites noted in the archaeological literature, on historic Soviet mapping and visible on satellite imagery. Where correlation is certain, this is noted in the text.

Archaeological sites within 5km of the Solar Array and Transmission Line route options are denoted with an '**ACH**' prefix.

6.6.6.1 Topography, geology, soils and land-use

The Project is located in the Sherabad District of Surkhan-Darya province, and the proposed Transmission Line will traverse Sherabad, Kizirik and Dzharkurgan districts. The existing Surkhan substation is located in the Dzharkurgan district.

The Solar Array is located east of the eastern foothills of the Kugitang mountain range, the Udantau and Pyshtykara mountains, east of the Gazdagan Gorge and southeast of the Daralitau Ridge. It is located southwest of the village of Talashkan and northeast of the village of Boz-Rabat. The Solar PV site was cultivated in the 1970s and 1980s, but was abandoned due to lack of water and soil exhaustion. The site is occasionally used as pasture briefly in spring, before the herds are taken to the mountains.

The Transmission Line crosses the low-lying landscape of the Sherabad plain, characterised by extensive irrigation channels, canals and agriculture centred around Sherabad, Ulanbulak, Angor and Karasu. The eastern end of the route, west of Dzharkurgan, crosses the Kattakum Sands, an arid area distant from irrigation canals. This desert, and the Haudag Ridge, separate the Sherabad Darya to the west from the irrigated lands of the middle and lower reaches of the Surkhan Darya to the east (see.

The underlying geology of the area comprises Mesozoic Cretaceous rock capped with Neogene deposits and deposits of Quaternary alluvial outwash and wind-blown deposits which correspond to the Pleistocene. In the Kugitang Natural Reserve in eastern Turkmenistan c. 40km northwest of the Solar Array site, rocks of the Precambrian, Palaeozoic, Mesozoic, and Cenozoic Eras are rich in fossils of molluscs, brachiopods, and dinosaurs – including dinosaur footprint trails[59]. However, the PAI itself has very limited palaeontological potential and this aspect has therefore been scoped out of this assessment.

[59] UNESCO Tentative List, Turkmenistan Ref. 5434. Dinosaurs and Caves of Koytendag. Available at: https://whc.unesco.org/en/tentativelists/5434/

Soils in the Project area comprise irrigated *takir* soil (salinated clay), solonchaks[60] on alluvial or proluvial sediments, light solonchak luvisol, and grey-brown soils[61].

The Sherabad plain is located between the Amu Darya (Oxus) and Surkhan Darya rivers. South of the Transmission Line, the Zang Canal built in 1973 separates this irrigated area from a very intensively cultivated narrow strip of land on the right bank of the Amu Darya. During the Soviet period, cotton and cereal cultivation in the study area was increased by the development of a dense network of irrigation channels fed by many minor channels of the Sherabad Darya and the Sherabad Canal, fed by the Kumkurgan Dam on the Surkhan Darya, built in 1971. Agricultural intensification began in the 1970s and 1980s, with the expansion of canals, *arik* channels to irrigate cotton, wheat and rice fields and horticultural gardens (*dekhan*); and *zeber* channels to drain water out from these fields into the previously uncultivated steppe. The population increased and some villages expanded. This ongoing development has resulted in the plough-levelling of numerous archaeological sites indicated on historic mapping and satellite imagery. However, archaeological remains persist in the form of buried features and finds scatters.

The Surkhandarya region is particularly significant in the Bronze Age, Early Iron Age and Kushan period. The region had long-distance contacts, connecting to northern India and Bactra in Afghanistan via Termez and to Sogdian centres via the 'Iron Gates' pass to the north, at Derbent (Baysun District).

6.6.6.2 Previous Archaeological Investigations

The Surkhan Darya valley has been subject to extensive surface survey, as well as investigation using modern technology such as satellite imagery by various Soviet, Uzbek and international missions.

The first investigations in the area were undertaken by antiquarians and travellers. In 1890-91, E.F. Khal noted ancient fortresses built on artificial platforms and traces of old irrigation ditches[62]. In 1912, Col. Anaiev noted archaeological monuments in the Termez, Angora, Sherabad and Dzharkurgan districts, noting artificial hillocks with the remains of adobe structures and fired bricks. The first formal archaeological mission to the area explored Old Termez and the surrounding area in 1926-1928. In 1936, The Termez Archaeological Complex Expedition studied sites in Surkhandarya Province. The Palaeolithic and Neolithic of the Sherabad area were first investigated in the 1930s and 1940s[63]. In 1949 the Surkhan Darya detachment of the Uzbek Archaeological Expedition undertook reconnaissance along the Surkhan Darya river and near Angora, on the Sherabad Darya. In the 1950s and 1960s attention was focused on Termez and sites in the south of Surkhandarya Province. The first modern investigations of the Sherabad Oasis began in the 1970s with the Bactrian Archaeological Expedition, when E.V. Rtveladze and Sh. Pidaev carried out systematic walkover survey, mapping sites and monuments, focussing on Antique period, Kushan sites[64]. Land use potential[65] and ethnographic

[60] Solonchaks occur where saline groundwater comes near to the surface, or where through evapo(transpi)ration salts from the soil water accumulate in the soil. ISRIC - International Soil Reference and Information Centre, available at: https://www.isric.org/explore/world-soil-distribution/solonchaks

[61] Genusov, A.Z., Gorbunov, B.V. & Kimberg, N.V. (1961) Pochvennuyu kartu Uzbekskoy SSR. Uzbekskaya akademiya sel'skokhozyaystvennykh nauk, institut pochvovedeniya. [Soil Map of Uzbek SSR Uzbek Academy of Agricultural Sciences, Institute of Soil Science]. Oformleno i otpechatano na Tashkentskoy kartfabrike. Available at: http://www.etomesto.ru/map-asia_uzbekistan_pochva-1960

[62] Al'baum L.I. (1960) Balalyk-tepe. K istorii material'noj kul'tury i iskusstva Toharistana. [Balalyk-tepe. History of material culture and art of Tokharistan]. Tashkent: Academy of Sciences, p. 8.

[63] Parfyonov, unpublished – Stančo, L & Tušlov, P. (eds.) (2019) note that a typescript is held in the archives of the Termez Archaeological Museum; Pougatchenkova, G. (2001) Histoire des recherches archéologiques en Bactriane septentrionale. Région du Sourkhan Darya, Ouzbékistan (jusqu'à la création de la MAFOuz B), In P. Leriche, P. Leriche, C. Pidaev, K. Abdoullaev, M. Gelin et K. Abdoullaev (eds) La Bactriane au carrefour des routes et civilisations de l'Asie centrale. Actes du colloque de Termez 1997. (La Bibliothèque de l'Asie Centrale, 1), Paris: Maisonneuve et Larose, pp. 23–34.

[64] Rtveladze, E.V. & Khakimov, Z.E. (1973) Marshrutnyye issledovaniya pamyatnikov severnoy Baktrii [Walkover investigation of the monuments of northern Bactria]. In: Pugachenkova, G.A. (ed.) Iz istorii antichnoy kul'tury Uzbekistana, Tashkent, pp. 10–34; Rtveladze, E.V. (1974) Razvedočnoe izučenie Baktriyskyč pamyatnikov na yuge Uzbekistana [Exploration study of Bactrian monuments in the southern regions of Uzbekistan]. In: Masson, V.M. (ed.) Drevnyaya Baktriya, pp. 74–85. Leningrad: Nauka; Rtveladze, E.V. (1976) Noviye drevnyebaktriyskie pamyatniki na yuge Uzbekistana. [New ancient Bactrian monuments in the south of Uzbekistan]. In: Masson, V.M. (ed.) Baktriyskie drevnosti, Leningrad: Nauka, pp. 93–103; Aršavskaja, Z.A., Rtveladze, È.V. & Hakimov, Z.A. (1982) Srednevekovye pamjatniki Surhandarji [Medieval monuments of Surkhandarya]. Taškent; Pidaev, Sh. P (1974) Materialy k izucheniyu drvnikh pamyatnikov Severnoy Baktrii [Materials for the study of other monuments of Northern Bactria]. In: Drevnyaya Baktriya, ed.: Masson, V. M., Leningrad, pp. 38–40; Pidaev, Š. (1978) Poseleniya kušanskogo vremeni severnoy Baktrii. [Settlement of the Kushan period in northern Bactria]. Taškent; Masson, V. M. (1974) Problema drevnego goroda i arkheologicheskiye pamyatniky severnoy Baktrii [The problem of the ancient city and archaeological monuments of northern Bactria]. In: Drevnyaya Baktriya, ed.: Masson, V. M., Leningrad, pp. 5–6; Pugačenkova, G. A. & Rtveladze, E.V. (1990) Severnaia Baktriia Tokharistan. [Northern Bactriana – Tokharistan. Taškent: Fan; Ergešov, S. (1974) Šovkat Ergešov. Landšafty Surkhandar'inskoi oblasti. [Landscapes of the Surkhandarya region]. Taškent: Fan.

[65] Ergešov, S. (1974) Šovkat Ergešov. Landšafty Surkhandar'inskoi oblasti. [Landscapes of the Surkhandarya region]. Tashkent: Fan.

studies were also undertaken, considering land-use and interaction between ethnic groups[66]. Surveys in the 1980s sought to map early medieval[67] and medieval sites[68]. There were excavations of major Bronze Age sites such as Jarkutan and Bustan[69]. Early Iron Age sites including Talashkan I have been excavated[70]. The Kugitang foothills have also been subject to survey[71].

From the 1990s, French, Russian, German, Japanese[72] and Czech teams have worked in the area. The Franco-Uzbek Archaeological Mission in Bactria (MAFOuz de Bactrianie) has investigated and mapped settlement patterns in the area[73]. In 1993, the German-Uzbek Archaeological Expedition began field investigations at Jandavlattepa citadel, c. 2.7km north of the 220kV Transmission Line [small mounds **ACH081**-**ACH085**; settlement mound **ACH087**][74]. From 2002, the Czech-Uzbek Archaeological Expedition in southern Uzbekistan continued excavations at Jandavlattepa[75].

The Czech-Uzbek expedition has also undertaken field survey south of Sherabad[76]. This involved fieldwalking and test pitting, review of published archaeological data, historical maps and satellite images, and analysed the development of the settlement throughout this oasis and the development of the irrigation systems in the steppe lowlands. Fieldwalking was undertaken in some areas in the vicinity of the 220kV Transmission Line route in 2008–2011 and 2014:

- c. 2.4km north of the 220kV Transmission Line west of Talashkantepa II [**ACH072**] near smaller mounds [**ACH068**-**ACH070**], which may be the remains of small dwellings.
- c. 5km north of the 220kV Transmission Line, at Kulugshakhtepa, south of Sherabad, investigations found high medieval pottery (10th to 14th century) with small amounts of Kushan, Kushano-Sasanian, early medieval and 16th to 18th century pottery.
- c. 2.8km north of the 220kV Transmission Line at Jandavlattepa (small settlement/?tepa mounds **ACH081**-**ACH085**; settlement mound **ACH087**). Jandavlattepa citadel dates from the early Iron Age to the Kushano-Sasanian period; fieldwalking recovered Kuchuk early Iron Age pottery, Kushano-Sasanian and early medieval pottery, and identified a Greco-Bactrian or Kushan period funerary structure.
- c. 450m north of the 220kV Transmission Line at Dzharty-Aryk, in the vicinity of settlement mound **ACH088** and smaller mound **ACH120**.

Although there is a great deal of literature – and even more unpublished research – the georeferencing, orthography and naming of sites identified during the Soviet period and in the State Register is poor and it has not proved possible to reliably link State Register sites to sites identified by other researchers, to Soviet mapping or to satellite imagery. A definitive, ground-truthed GIS for the area is still in preparation.

A gazetteer of cultural heritage assets identified from literature search, historic mapping and satellite imagery is presented as an Appendix. This appendix includes, where known, cross-references to sites

[66] Karmyševa, B.K. (1976) Očerki etničeskoi istorii iužnykh raionov Tadžikistana i Uzbekistana. [Essays on the ethnic history of the southern regions of Tajikistan and Uzbekistan]. Moskva: Nauka.
[67] Annaev, T. (1988) Rannesrednevekoviye poseleniya severnogo Tokharistana. [Early medieval settlements in northern Tokharistan]. Tashkent.
[68] Aršavskaja, Z.A., Rtveladze, È.V. & Hakimov, Z.A. (1982) Srednevekovye pamjatniki Surhandarji [Medieval monuments of Surkhandarya]. Taškent; Rtveladze, E.V. (1990) On the Historical Geography of Bactria-Tokharistan. Silk Road Art and Archaeology 1, pp. 2–33.
[69] Askarov, A.A. (1977) Istorija material'noj kul'tury Uzbekistana Vypusk [Ancient agricultural culture of the Bronze Age in the south of Uzbekistan]. FAN: Taškent; Askarov, A.A. & Abdullaev, B.N. (1983) Džarkutan (K probleme protogorodskoj civilizacii na juge Uzbekistana). [Dzharkutan (On the problem of proto-urban civilization in the south of Uzbekistan)]. FAN: Taškent
[70] Shaydullaev, Sh. (2000) Severnaja Baktriya v epokhu rannego zheleznogo veka [Northern Bactria in the Early Iron Age Period Tashkent; Shaydullaev, Sh. (2002) Untersuchungen zur frühen Eisenzeit in Nordbaktrien [Investigations into the early Iron Age in Northern Bactria]. *Archäologische Mitteilungen aus Iran und Turan* 34, pp. 243–339; Rtveladze, È.V. & Pidaev, Š.R. (1993) Drevnebaktrijskaja krepost' Talaškan-tepe I. [Ancient Bactrian fortress Talashkan-tepe I]. RA.M., 1993 № 2, pp. 133–147.
[71] Bobohadžaev, A., Annaev, T.& Rahmanov, Š. (1990) Nekotorye itogi izučenija drevnih i srednevekovyh pamjatnikov predgornoj i gornoj polosy Kugitang – Bajsuntau. [Some results of the study ancient and medieval monuments of the Kugitang - Baysuntau foothills and mountain range]. Istorija Material'noj Kul"tury Uzbekistana 23, pp. 25–36.
[72] Tanabe, K., A. Hori, K. Ishida, M. Tsumura, K. Yamauchi and R. Takeuchi (1996) Excavation at Dalverzin Tepe, 1996 [in Japanese with English summary]. Bulletin of the Ancient Orient Museum 17, pp. 101–122.
[73] Stride, S. (2004) Géographie archéologique de la province de Surkhan Darya (Ouzbékistan Sud / Bactriane du nord; [Archaeological Geography of the Province of Surkhan Darya]. Unpublished dissertation, Université Paris I Panthéon-Sorbonne; Stride, S. (2007) Regions and territories in Southern central Asia: what Surkhan Darya Province tells us about Bactria. In J. Cribb & G. Hermann (eds.) After Alexander: Central Asia before Islam. Oxford, pp. 99-117
[74] Huff, D. (1997) Deutsch-Uzbek Ausgrabungen auf dem Džandaulattepe und in Džarkutan, Süduzbekistan, 1993–1995 [German-Uzbek excavations on the Jandavlattepa and in Jarkutan, South Uzbekistan, 1993–1995]. Mitteilungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, 18, pp. 83–95.
[75] Abdullaev, K. & Stančo, L. (eds.) (2011) Jandavlattepa. The Excavation Report for Seasons 2002–2006, vol. 1, Prague
[76] Stančo, L & Tušlov, P. (eds.) (2019) Sherabad Oasis: Tracing Historical Landscape in Southern Uzbekistan. Reports of Czech-Uzbekistani Archaeological Mission in southern Uzbekistan Volume 2. Karolinum Press, Prague.

identified in the gazetteers of the recent Czech-Uzbek Archaeological Expedition, Sebastian Stride's 2004 catalogue and the 1970s and 1980s surveys of Edvard Vasilevich Rtveladze.

The Site has not yet been subject to archaeological investigation (State Expertise). This will be undertaken as part of the national OVOS assessment process.

Following the recent formation of the national Agency for Cultural Heritage[77], the Register of Tangible Cultural Heritage Properties is to be revised, resurveyed and records updated. This process has the potential to reveal or identify previously unrecorded heritage assets within the study area.

Key Bronze Age to Kushan period settlement sites in the wider area noted in the text are illustrated on Figure 63 below.

[77]Presidential Decree No. PF-6199 of 6 April 2021 "On measures to further improve the system of public administration in the fields of tourism, sports and cultural heritage". Available at: https://lex.uz/docs/5356705

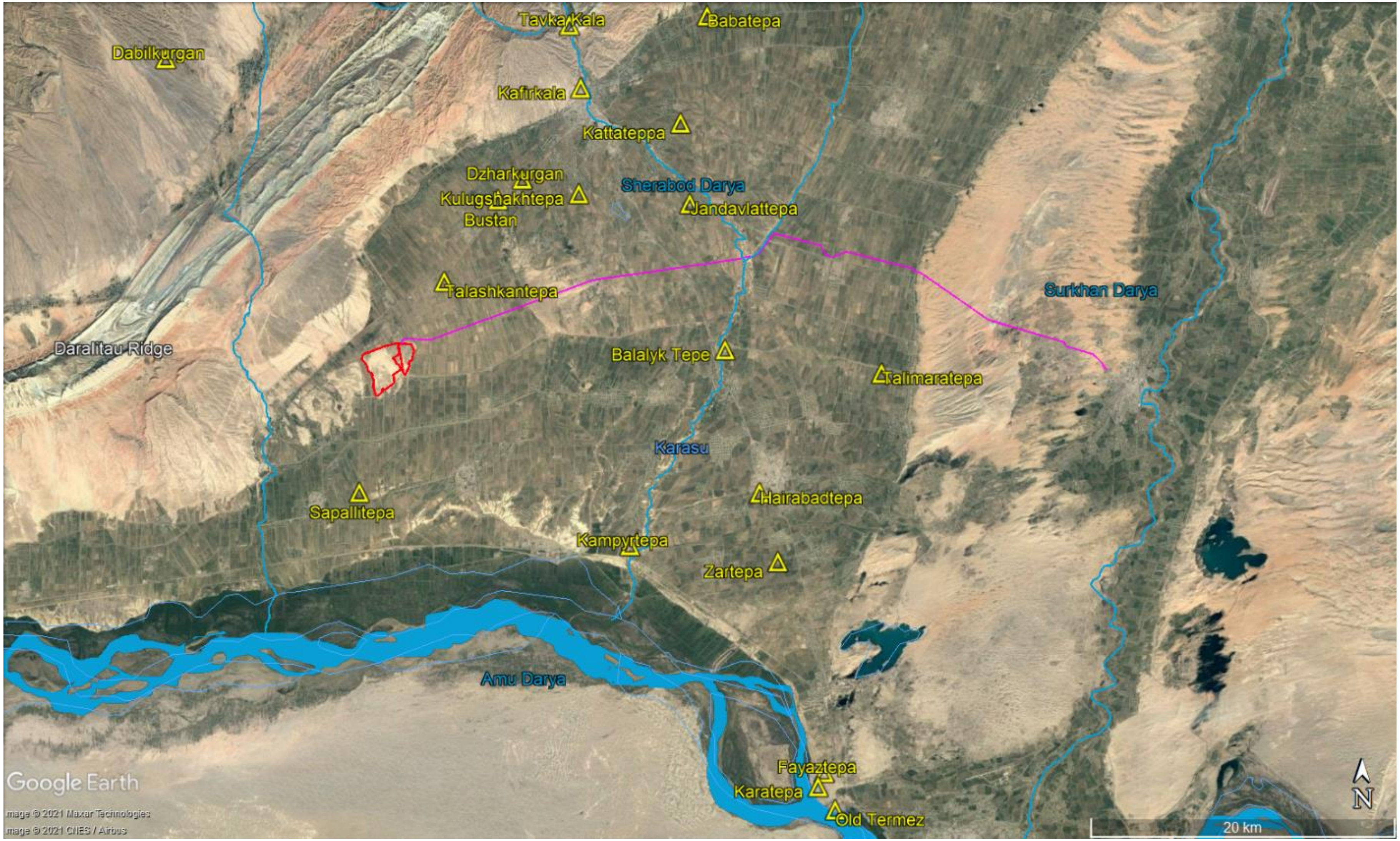

Figure 6-41. Location of key Bronze Age to Kushan period settlement sites in the wider area

6.6.6.3 Archaeological and Historical Background

Palaeolithic (140,000 BP to c.12,000 BP)

Past climates may have influenced the location and extent of past human occupation. The Last Interglaciation in Central Asia (130–75,000 BP (Before Present)) was followed by the First Glacial Maximum (74–60,000 BP), then a warm early phase, part of the oxygen isotope stage (OIS) 3 interstadial (59–44,000 BP), finishing with the local Last Glacial Maximum in Central Asia (43–28,000 BP)[78]. Studies suggest that during late Pleistocene and Holocene glacial-interglacial transitions in Central Asia, hominin populations did not abandon the area, but may have aggregated in areas with the least seasonal temperature variations, or found other suitable niches such as caves[79]. This could indicate that the climate was not as hostile as traditionally considered, that populations adapted rapidly to a changing climate, or that in some cases, populations – of both Neanderthals and anatomically modern humans – sought refuge in the milder deserts and plains of the continental steppe during glaciations, perhaps resulting in hybridisation[80].

Over time, the Central Asian plains have become increasingly arid; however, the proximity of the Project to the Amur Darya, Sherabad Darya and Surkhan Darya rivers would have made the area habitable. At Teshik Tash cave at Bajsuntau in the Gissar mountains, the fossilised remains of a Neanderthal child were excavated in 1938 and many stone tools, dating to c. 100,000 – 4,000 BCE (Before the Common Era). Further Palaeolithic remains were found at the nearby Amir Temir cave[81]. Palaeolithic tools have been recovered from the banks of the Tupalang River, north of Denau. These sites are over 80km north of the Project. Rock shelters are also known from the Kugitangtau Mountains.

Known palaeolithic sites are principally located in the relatively low-elevation foothills, in caves, along gorges (*sais*) and adjacent to natural springs. Some are, however, located in the deep alluvial sequences associated with ancient river terraces in desert plains, though upland sites tend to be better preserved[82].

Mesolithic (12,000-5000 BCE) and Neolithic (5000-4000 BCE)

During the late Pleistocene, the climate was cold and arid, which is assumed to have constrained human populations to lowland areas. Between c.8000 BCE and 7000 BCE, the climate became milder and more humid[83]. Stray finds of stone tools have been found across the region.

There are Mesolithic rock paintings showing hunting scenes and wild animals at the Zarautsoy limestone rock shelter in the Kugitangtau Mountains (State Register No 369), located c. 40km northwest of the PAI. The site also has Neolithic, Bronze Age and medieval rock art and inscriptions. This is also a Tentative List World Heritage Site (UNESCO Ref.: 5299)[84]. Numerous Mesolithic stone tools have been recovered during excavations at Old Termez and Ayrtam on the banks of the Amu Darya.

The Neolithic period is characterised by the development of arable agriculture and the domestication of animals, the development of new tools such as sickle blades and polished axes and the extensive use of ceramics. During the Neolithic, populations seem to have focussed on the foothills, around mountain

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[78] Meese, D.A., Gow, A.J., Alley, R.B., Zielinski, G.A., Grootes, P.M., Ram, M., Taylor, K.C., Mayewski, P.A. & Bolzan, J.F. (1997) The Greenland Ice Sheet Project 2 depth-age scale: methods and results. Journal of Geophysical Research: Oceans, 102, pp. 26411–26423; Glantz, M. (2010) The history of hominin occupation of Central Asia in review. In C.J. Norton and D.R. Braun (eds) Asian Paleoanthropology: from Africa to China and beyond. Dordrecht: Springer, pp. 101–112.

[79] Beeton, T.A., Glantz, M.M., Trainer, A.K., Temirbekov, S.S., Reich, R.M and Temibekov, S.S. (2014) The fundamental hominin niche in late Pleistocene Central Asia: a preliminary refugium model. Journal of Biogeography Vol. 41, No. 1, pp. 95–110.

[80] Glantz, M., Viola, B., Wrinn, P., Chikisheva, T., Derevianko, A.P., Krivoshapkin, A., Islamov, U., Suleimanov, R. & Ritzman, T. (2008) New hominin remains from Uzbekistan. Journal of Human Evolution, 55, pp. 223–237; Mallol, C., Mentzer, S.M. & Wrinn, P.J. (2009) A micromorphological and mineralogical study of site formation processes at the late Pleistocene site of Obi-Rakhmat, Uzbekistan. Geoarchaeology, 24, pp. 548–575; Kolobova, K.A., Krivoshapkin, A.I., Derevianko, A.P. & Islamov, U.I. (2011) The Upper Paleolithic site of Dodekatym-2 in Uzbekistan. Archaeology, Ethnology and Anthropology of Eurasia, 39, pp. 2–21.

[81] Okladnikov, A.P. (1949) Izuchenie mustierskoi stoyanki i pogrebenia neandertaltsa v grote Teshik-Tash, Yuzhnyi Uzbekistan, Srednyaya Azia [Investigations of the Mousterian site and the Neanderthal burial at the Teshik-Tash grotto, South Uzbekistan Central Asia]. In Gremiatsky M.A., Nesturkh M.F. (eds.), Teshik-Tash: Palaeolithic Man. Moskva, pp. 7–85.

[82] Beeton et al. (2014) op. cit.

[83] Vinogradov, A.V. & Mammadov, E.D. (1975) Pervobytnyj Ljavljakan. Ètapy drevnejšego zaselenija i osvoenija Vnutrennih Kyzylkumov [Primaeval Lyavlyakan. Stages of the most ancient settlement and development of Inner Kyzylkum]. Nauka, Moskva.

[84] Formozov, A.A. (1965) The Rock Paintings of Zaraut-Kamar, Uzbekistan. Rivista di Scienze Preistoriche 20, pp. 63–84; Formozov, A.A. (1969) Očerki po pervobytnomu iskusstvu. Naskal'nye izobraženija i kamennye izvajanija èpohi kamnja i bronzy na territorii SSSR. [Essays on Primitive Art. Rock carvings and stone sculptures of the Stone and Bronze Age on the territory of the USSR.] Moskva; Tashbayeva, K., Khujanazorov, M., Ranov, V. & Samashev, Z. (2001) Petroglyphs of Central Asia. Bishkek.

rivers and rock outcrops with springs and raw materials for making stone tools.[85]

Eneolithic/Chalcolithic (4000-2800 BCE) and Bronze Age (2800-900 BCE)

During the Copper Age, the population of the region grew, with small settlements, metalworking and pottery. In the Early Bronze Age, sedentary proto-urban societies developed[86]. The Oxus Civilisation[87] or Bactria-Margiana Archaeological Complex (c. 2400–1900 BCE) developed in regions suitable for intensive farming, such as the fertile areas along the Oxus River, the Surkhan Darya and the Sherabad Darya. The Oxus civilisation relied on intensive, irrigated agriculture. Arts and crafts flourished, with metallurgy (gold, silver, and bronze alloys of copper, lead and tin), wheel-thrown pottery production and precious stone-working (lapis-lazuli, carnelian, steatite, and alabaster) used in prestige display and long-distance trade.[88] The 'Lapis-Lazuli Road' linked north-eastern Afghanistan to the Mediterranean and China. The iconography and technology of the Oxus civilisation indicates links to civilisations in Mesopotamia and the Indus Valley.

In the Early Bronze Age, the dead were buried in wooden chambers and ceramic jars, sometimes beneath house floors, in the ruins of abandoned houses and streets and inside the wall fillings and corridors, and sometimes with offerings of animals. In the Middle and Later Bronze Age, most graves were individual, buried in pits, in an adobe brick niche or in jars with grave goods and food. These graves are often located in necropolises near to but separate from the cities. Some burials have been found in abandoned former settlements. There is some evidence for excarnation, sometimes interpreted as indicating early Zoroastrianism. In the Late Bronze Age, cremation became more widespread; this is sometimes attributed to Vedic influence.

Many urban settlements declined during the Middle Bronze Age (c. 2500–1800 BCE). This may have been due to climatic changes, the interruption of trade routes, and the migration of Indo-European tribes from the steppes in the north.

By the Late Bronze Age (c. 1800–1500/1400 BCE), many cities were abandoned and inter-regional exchange networks broke down[89]. Some argue that the 'collapse' of the Oxus civilisation was partly due to the hostile incursions of steppe nomads[90]. Others suggest that mobile pastoralists took advantage of a decaying power structure, but only occupied marginal and agriculturally unsuitable zones[91], or that they merged with local farming populations[92], with cultures influencing each other and some sites exhibiting elements of both traditions[93].

Several significant Bronze Age sites have been identified in the area. The Project footprint would have been located in their agricultural hinterland.

Sappalitepa, the earliest Bronze Age site in this region, is located on the banks of the Ulanbulaksay River. Sapallitepa was a square fortress measuring c. 82m in diameter, surrounded by three defensive walls. Inside the fortress were narrow streets and adobe houses, workshops where pottery and bronze tools, weapons and jewellery were made. Wheat and barley grains were stored in large jars. The Early Bronze Age in southern Uzbekistan is named the Sappalli Culture, after this site. It was excavated in

[85] Sarianidi, V. (1992) Food-producing and other Neolithic communities in Khorasan and Transoxania: eastern Iran, Soviet Central Asia and Afghanistan. In A.H. Dani & V. M. Masson (Eds) History of Civilizations of Central Asia, Vol. 1, pp. 109–126

[86] Masson, V.M. (2002) Cultures of the Steppe Bronze Age and urban civilizations in the south of Central Asia, in Jones-Bley, K. & Zdanovich, D.G. (ed.) Complex societies of Central Eurasia from the 3rd to the 1st millennium BC: regional specifics in light of global models. Washington, D.C.: Institute for the Study of Man, pp. 547–57.

[87] Francfort, P. H, (2005), La Civilization de l'Oxus et Indo-Iranian et Indo-Aryens en Asie Centrale. In G. Fussman, J. Kellens, H.-P. Francfort & X. Tremblay (Eds.), ryas, Aryens et Iraniens en Asie Centrale. Paris, Diffusion de Boccard, pp. 253–328.

[88] Sarianidi, V.I. (1981) Margiana in the Bronze Age. In KOHTL, P.L. (ed.) The Bronze Age civilization of Central Asia: recent Soviet discoveries. Armonk: M.E. Sharpe, Inc., pp. 165–93; Hiebert, F.T. (1994) Origins of the Bronze Age oasis civilization in Central Asia. Cambridge (MA): Peabody Museum of Archaeology and Ethnology.

[89] Luneau, É. (2014) The end of the Oxus civilization: transformations and reconstructions of societies of the Late Bronze Age in southern Central Asia (1800–1500/1400 BCE). Paris: Éditions de Boccard.

[90] Vinogradova, N.M. & Kuz'mina, E.E. (1996) Contacts between the Steppe and agricultural tribes of Central Asia in the Bronze Age. Anthropology & Archeology of Eurasia 34, pp. 29–54.

[91] P'yankova, L.T. (1993) Pottery of Margiana and Bactria in the Bronze Age. Information Bulletin of the International Association for the Study of the Cultures of Central Asia 19, pp. 109–27.

[92] Masson, V.M. (2002) Cultures of the Steppe Bronze Age and urban civilizations in the south of Central Asia, in Jones-Bley, K. & Zdanovich, D.G. (eds.) Complex societies of Central Eurasia from the 3rd to the 1st millennium BC: regional specifics in light of global models, pp. 547–57. Washington D.C.: Institute for the Study of Man.

[93] Frachetti, M.D. (2008) Pastoralist landscapes and social interaction in Bronze Age Eurasia. Berkeley: University of California Press; Rogers, J.D. (2012) Inner Asian states and empires: theories and synthesis. Journal of Archaeological Research 20, pp. 205–56; Honeychurch, W. (2015) Inner Asia and the spatial politics of empire: archeology, mobility, and culture contact. New York: Springer.

1969 and 1971 by A. Askarov of the Institute of Archaeology of the Academy of Sciences of the Uzbek SSR[94]. Sappalitepa is located c. 6.5km south of the Solar Array sit

Figure 6-42. Sappalitepa, Burial 8

Source: Askarov 1973, plate 23.

At **Dzharkurgan** (State Register No. ?386, 387), excavations recorded the ruins of a once densely-populated ancient city. It began as a small settlement with grain silos in the Middle Bronze Age c. 2100–1500 BCE, then in the Late Bronze Age developed into an increasingly complex city. The 100ha tepa mound has a citadel with a fortified 'temple' and 'palace', a brick-built *shakhristan* with adobe artisan quarters and dwellings, and several necropolises with Middle to Late Bronze Age graves. Pottery of the semi-settled Tajik Vakhsh culture has been recovered. Evidence for bronze metalworking and a pottery workshop was recorded.[95] The site has been investigated by Soviet[96], Uzbek-German[97] and Uzbek-French (MAFOuz-Protohistoire) expeditions.[98] Dzharkurgan (southwest of Sherabad, distinct from the town of the same name on the Surkhan Darya), is located c. 7.3km north-northwest of the Transmission Line.

Figure 6-43. MafOUZ excavations in progress at Dzharkurgan

Source: Bendezu-Sarmiento & Mustafakulov 2013, fig. 6b

[94] Askarov, A.A. (1973) Sapallitepa. Tashkent. Available at: https://n.ziyouz.com/books/uzbeklib_ru/literatury_po_istorii_tjurkskih_narodov/Askarov%20A.%20Sapallitepa.pdf

[95] Luneau, E., Bendezu-Sarmiento, J. & Mustafakulov, S. (2014) Ceramics and Chronology at Dzharkutan: a Revision of the Periodization of the Sapalli Culture (Uzbekistan, c. 2100-1500 BC). Proceedings of the 8th International Congress on the Archaeology of the Ancient Near East Volume 2. Wiesbaden: Harrassowitz Verlag.

[96] Askarov, A.A. & Abdullaev, B.N. (1983) Dzharkutan, Tashkent; Askarov, A.A. & Shirinov, T. Sh. (1993) Rannjaja gorodskaja kul'tura epokhi bronzy juga Srednej Azii. [Early Urban Bronze Age Culture of the South of Central Asia]. Samarkand.

[97] Huff, D (2000) Djarkurtan. Archaeological Research on Tepe VI. In Istorija Material'noj Kultury Uzbekistana 31, pp. 58–69.

[98] Bendezu-Sarmiento, J. & Mustafakulov, S. (2013) Le site proto-urbain de Dzharkutan durant les âges du bronze et du fer. [The proto-urban site of Dzharkutan in the Bronze Age and Iron Age] Recherches de la Mission archéologique franco-ouzbèke-Protohistoire. In J. Bendezu-Sarmiento (ed.), L'archéologie française en Asie centrale. Nouvelles recherches et enjeux socioculturels, Cahiers d'Asie Centrale 21-22, IFEAC-De Boccard, pp. 207–236. Available at: https://journals.openedition.org/asiecentrale/1822

Bustan (State Register No. ?388, 389, 390), located west of Dzharkurgan, is a large necropolis dated to the mid-2nd millennium BCE. Burials include catacomb chambers, niche-type burials and pit-type graves. There were both inhumation and cremation burials. Cremation hearths and altars have been identified.[99] Bustan is c. 6.8km northwest of the Transmission Line.

Figure 6-44. Anthropomorphic figurines from graves, Bustan

Source: Avanessova & Lyonnet 1995, figs. 14 & 17

Iron Age (c. 1500 – 329 BCE)

During the Early Iron Age (Yaz I period, c. 1500–1000 BCE) the landscape would have been characterised by a profusion of smaller rural settlements in scattered oases, with improved irrigated agriculture and small, walled 'citadel' buildings. Settlement sometimes opportunistically re-used earlier *tepa* sites. Artefacts were principally utilitarian, with stone and metal tools, and mostly handmade pottery, sometimes ornamented with monochrome painting. The religious iconography and temples of the Oxus civilisation disappeared.

The Middle Iron Age (Yaz II period) began c. 1000 BCE and is characterised by wheel-made pottery and iron metallurgy. It ended with the integration of Bactria into the into the Persian Empire, in the 7^{th} and earlier 6^{th} century BCE.

The Late Iron Age (Yaz III period) correlates to the Achaemenid period, starting with the conquest of large parts of Central Asia under Cyrus II around 539 BCE up to the successful campaigns of Alexander the Great in 329 and 328 BCE.

This period is also known as the Iron Age Sine Sepulchro Cultural Complex of Transoxiana as it is characterised by the general absence of burials. Inhumation was largely replaced by the open-air exposure and the excarnation of bodies. Elements of skeletons are sometimes buried or incorporated into houses or grain silos.

Iron Age sites in the vicinity of the Project include:

Jandavlattepa (ACH087; State Register No. 339) is an enclosed settlement mound close to the Sherabad Darya riverbed. It is a large compact mound with a separate citadel. There is a modern graveyard with recent grave pits on the surface. It has been dated to the Early Iron Age, Achaemenid, Seleucid, Greco-Bactrian, Yuezhi, Kushan and Late Antique periods. Surrounding fields have been investigated by Czech-Uzbek Archaeological Expedition . Located c. 4km north of the Transmission Line.

[99] Avanessova, N.A. & Lyonnet, B. (1995) Bustan VI, une nécropole de l'âge du Bronze dans l'ancienne Bactriane (Ouzbékistan méridional): témoignages de cultes du feu. Arts asiatiques 50, pp. 31–46.

Figure 6-45. Excavations at Jandavlattepa. Institute for Classical Archaeology, Charles University, with Archaeological Institute of the Academy of Sciences, Samarkand

Talashkantepa I (**ACH073**; State Register No. 336) is a low, rounded mound which has been fully excavated in 1976[100]. It was found to be of Early Iron Age date. Located c. 2.7km northwest of the Transmission Line.

Dzharkurgan (State Register No. 386, 387). An Iron Age village of pit-houses was built on the ruins of the Bronze Age settlement, lasting until c.1000–900 BCE[101]. Located c. 7.8km north of the Transmission Line.

Greco-Bactrian (329 – c. 145 BCE)

The region was captured and annexed by Alexander the Great in 329 BCE. Following Alexander's death, the satrapies of Sogdiana and Bactria passed to Phillip of Macedon then fell to the Seleucids. In 256 BCE Bactria and Sogdiana broke away from the Seleucid Empire, forming a separate Hellenistic Greco-Bactrian kingdom, which lasted until between 141 and 129 CE. At this time that the Silk Route to China developed. Travelling merchants and middlemen went on to spread faiths such as Manicheism, Zoroastrianism, and Buddhism along the Silk Road.

It is likely that Old Termez is the site of the city of Alexandria on the Oxus. Termez was a cosmopolitan crossroads of cultures, linking Mediterranean, Indian, Persian, Chinese and central Asian civilisations. Ancient Termiz is a Tentative List World Heritage Site (Ref. 5298)[102].

Sites in the vicinity of the Project, such as **Talashkan II (ACH072)** and **Jandavlattepa (AC087; ACH124)** demonstrate continuity into the Greco-Bactrian period. Greek culture became increasingly dominant in the 3rd to 2nd century BCE, and Hellenistic culture is evidenced in architecture, urbanisation, coinage, and glasswork and stone carving[103].

Kushan, Sasanian, Kidarite and Hephthalite Kingdoms and Principality of Toharistan (c. 145 BCE – 7th century CE)

The nomadic invasions of Scythians and Yuezhis from c.145 BCE destroyed settlements in the southern oasis areas, and the land reverted to desert where irrigation systems were disrupted. The Scythians were gradually subsumed into the Kushan Empire from the late 1st century BCE to mid-4th century CE.

[100] Sagdullaev, T. & Khakimov, Z.E. (1976) Raskopki drevnebaktriyskogo poseleniya Talaškan-Tepe I, In: Baktriyskiye drevnosti [Excavations of the ancient Bactrian settlement Talashkan-Tepe I. Bactrian antiquities], pp. 13–24.
[101] Askarov, A.A. (1976) Raspisnaâ keramika Džar-Kutana, in: Masson, V.M. (Ed.), Baktrijskie drevnosti. Predvari-tel'nye soobŝeniâ ob arheologicheskih rabotah naûge Uzbekistana, [Painted ceramics of Jar-Kutan. Bactrian antiquities. Preliminary reports on archaeological work in the south of Uzbekistan]. Leningrad, pp. 17–19; Lhuillier, J., Bendezu-Sarmiento, J & Mustafakulov, S. (2018) Excavation at Džarkutan (Uzbekistan): A Settlement of the Early Iron Age in Southern Central Asia, in: Lhuillier, J. & Boroffka, N. (Eds.), A Millennium of History: The Iron Age in Southern Central Asia (2nd and 1st Millennia BC), Dedicated to the Memory of V.I. Sarianidi. Proceedings of the Conference Held in Berlin (2014). Archäologie in Iran und Turan 17/ Mémoires de la Délégation archéologique française en Afghanistan, 35. Berlin.
[102] UNESCO World Heritage Centre – Tentative Lists. Ancient Termiz. Available at: https://whc.unesco.org/en/tentativelists/5298/
[103] Mairs, R. (2020) Iran and central Asia in the Achaemenid and Hellenistic periods. In Hollander, D. & Howe, T. (Eds.) A Companion to Ancient Agriculture. Blackwell Companions to the Ancient World. Wiley-Blackwell, pp. 565–574

The Buddhist Kushan Kingdom traded with India, China, and the Roman Empire. Termez became an important centre for Mahāsāṃghika Buddhism[104]. Zurmala Tower, part of a large stupa, was built in the 1st to 2nd century CE. The Karatepa rock-cut temple complex dates to the early 2nd to 4th century CE. The Fayaztepa Buddhist monastery and temple complex dates from the 1st century BCE, flourishing in the 3rd century CE.

The Kushan Kingdom was defeated by the Sassanids in the 225 CE, who established the Kushano-Sasanian Kingdom in Bactria. This kingdom was eventually overwhelmed by the invasion of the Kidarite Huns from the north in 360–370 CE, who based their capital in Samarkand. The Kidarites were succeeded by the Hephthalites c. 450 CE, trading with Iran, Byzantium, India, and China. In 560 CE, the Hephthalites north of the Oxus were defeated by semi-nomadic Turkic tribes of Altai. Allied with Byzantium and exacting tribute from China, the First Turkic Khaganate established the Principality of Toharistan under the suzerainty of the Western Turks. Toharistan flourished in the 7th century CE.

Site in the vicinity of the Project that date to this period include:

Balalyk-tepe (ACH131), located north of Angor, c. 5.5km south of the Transmission Line, was a residential complex discovered and excavated by L.I. Al'baum (1953–55). The adobe structure was erected on a mud (*pasha*) square platform (30 × 30 m). One of the rooms had a frieze of wall paintings depicting a feast. It is dated to the 6th century to the early 7th century CE.[105]

Figure 6-46. Balalyk Tepe banquet scene, 6th-7th century CE. Public domain

Source: Wikimedia Commons.

Talashkantepa II (**ACH072**; State Register No. 337) is a high, compact pair of mounds. The western mound was investigated in the 1970s and found to be of Greco-Bactrian, Yuezhi, Kushan and early modern date. The eastern mound dates to the Kushan period. Located c. 2.8km northwest of the Transmission Line.

Arab conquest and Khanate of Transoxiana (Maveraunnakhr) (late 7th to 16th century)

Termez was seized by the Arab general Musa ibn Abdallah ibn Khazim in 689 CE. Transoxiana/ Maveraunnakhr was not fully pacified and integrated into the Umayyad Caliphate until 714. During the 9th to 10th centuries, Termez and the region of Chaghaniyan, on the right bank of the Amy Darya, came under the control of the Samanids. It became one of the largest trading and cultural centres in Central Asia, an Islamic cultural centre for art, architecture, literature, and thought. In the 12th century, Termez passed to a series of Turkic dynasties: the Kharkanids, Seljuks, Ghaznavids, Gurids and Khorzemshahs. Between 1219 and 1221, Mongol warriors led by Genghis Khan devastated Maveraunnakhr. Termez was besieged by Genghis Khan in 1220, who slaughtered its population and completely destroyed the city.

New Termez was constructed to the east of the old city in the 14th century. It prospered in the Timurids and was a key trading link to northern India.

[104] Esparraguera, J.M.G., Gil, E.A., Ferreras, V.M., & Pidaev, S.R. (2015) The Buddhist occupation of Tchingiz Tepe (Termez, Uzbekistan) in the Kushan period through the ceramic contexts. Archaeological Research in Asia, 3, pp. 19–33
[105] Al'baum L.I. (1960) Balalyk-tepe. K istorii material'noj kul'tury i iskusstva Toharistana. [Balalyk-tepe. History of material culture and art of Tokharistan]. Academy of Sciences, Tashkent; Nielsen V.A. (1966) Stanovlenie feodal'noj arhitektury Srednej Azii (V–VIII vv.) [Formation of feudal architecture in Central Asia (5th-8th centuries)]. Tashkent; Khmelnitsky S. (2000) Meždu kušanami i arabami [Between the Kushans and Arabs]. Riga

Key sites of this period include mosques and madrasahs, minarets, mausoleums and cemeteries. Dzharkurgan Minaret (**ACH116**; State Register Architectural Monument 203), located c. 4.8km south of the Electricity Substation, was built by Muhammad bin Ali Al-Sarkhasi in 1108-1109 AD. It is a Tentative List World Heritage Site (Ref. 5298)[106], part of the Ancient Termiz nomination. The tomb of Abu Isa At-Termizi was built east of Sherabad in the 12th century (Surkhandarya Regional List No. 29; State Register Site No. 406).

Emirate of Bukhara and Russian Empire (16th to 19th century)

The area became a part of the independent Emirate of Bukhara in the 16th century, submitting to the Uzbek Shaybanid (1500–1599), Janid (1599–1747) and Manghit (1753–1920) dynasties. It was eclipsed by the capital, Bukhara. The area declined in prosperity, partly due to the reduction in caravan trade along the Silk Roads resulting from the rise of maritime trade routes. Following internecine wars, by the later 18th century, most of the city was again abandoned, with occupation shifting to the village of Pattakesar and Salihabad.

In 1887, the Russian Empire began to operate a fleet on the Amy Darya, and Termez became a garrison town on the edge of the Russian Empire in 1894. Russia increased its troops in the area and demanded land concessions from the Emirate of Bukhara. In 1900, extensive territories in the lower reaches of the Surkhandarya River were ceded to the Russia Empire. The Anglo-Russian Convention of 1907 defined the Amy Darya as the southern frontier of the Russian Empire in this area, recognising British influence over Afghanistan.

Russian resettlement to Termez/Pattakesar area began in 1900, with the expulsion of the local population from their homes and seizure of fertile lands. The Termez irrigation system was created in 1905. The Samarkand-Termez postal road was built in 1902 and the Kagan-Termez railway in 1916, strengthening links to Russian Empire.[107]

Soviet period (1920 – 1991) and Independence (1991–present)

In 1920, the Red Army captured Bukhara and extinguished the khanate. The area became part of the Bukharan People's Soviet Republic. The Uzbek S.S.R. (now Uzbekistan) was created in 1924. Traditional pastoral nomadism was virtually abolished by Soviet forced collectivisation in the 1920s and 1930s.

In the 1970s and 1980s, irrigation projects were undertaken in the Sherabad Oasis area to colonise the steppe and develop intensive cotton and wheat cultivation. The Amu Zang Canal irrigation system was installed in 1973. Historic mapping and satellite imagery shows complex irrigation networks associated with wells, pumping stations and canals.

Uzbekistan declared independence from the U.S.S.R. in 1991.

6.6.7 Archaeology and Cultural Heritage Baseline Conditions

6.6.7.1 Tangible Cultural Heritage

The PAI has been subject to archaeological field survey (State Expertise). The wider area has been subject to systematic and recent archaeological field research and an archaeological GIS of the region is in preparation but not yet published.

Known Archaeological Sites

A review of the known archaeology and history of the wider Project area indicates that there is low potential for the presence of Palaeolithic, Mesolithic and Neolithic material. Throughout the later prehistoric, antique and medieval periods, it is likely that the Solar Array area was an upland area distant from the fertile Sherabad Oasis. The Sherabad Oasis, located between the Amu Darya and the Surkhan Darya rivers, has had irrigated agriculture since the Bronze Age. The area crossed by the Transmission Line has strong potential for settlement and agricultural remains dating from the Bronze Age to medieval and post-medieval periods, associated with *tepa* settlements, surrounding farmsteads and irrigated fields.

[106] UNESCO World Heritage Centre – Tentative Lists. Ancient Termiz. Available at: https://whc.unesco.org/en/tentativelists/5298/
[107] Turopova, M.T. (2020) Migration Processes in Cities under the Emirates of Bukhara. Journal NX- 6/6, 509 –513. Available at: https://repo.journalnx.com/index.php/nx/article/view/1293

The area has been subject to extensive development projects during the Soviet period, particularly between the 1970s and 1980s. The construction of new canals and ploughing for cereal and cotton crops have destroyed or encroached upon many archaeological sites, permanently modifying the entire landscape. Many surviving monuments have been diminished by ploughing, resulting in a spread of findspots around them. Remains may be intact buried structural deposits, or may take the form of manuring scatters and demolition debris spread by ploughing and irrigation.

The location of ancient burial grounds in the Sherabad Oasis is poorly understood. Large late Bronze Age necropolises are known from Dzharkutan and Bustan, but there is little evidence for burials from protohistoric and early historic, pre-Islamic periods. Numerous Islamic cemeteries are present in the study area. It is possible that burials from intervening periods were shallow and have been lost to ploughing; or that other funeral rituals were used[108].

The combination of Soviet mapping and GoogleEarth satellite imagery is a proven tool for remote site prospection in topographically similar areas of Uzbekistan[109]. Archaeological sites identified in the vicinity of the scheme comprise:

- **Larger, rectilinear/polygonal 'tepa' tell-type settlement sites located on raised mounds, erected in lowland areas on the banks of major rivers and controlling the upper reaches of irrigation canals.** South of Sherabad along the Sherabad Darya and east, towards the Surkhan Darya, is an area of fertile land, cultivated and irrigated from Achaemenid times onwards. This area contains a series of *tepa* tell-type settlement sites located on low hills (e.g. Talashkan [**ACH072**], Jandavlattepa [**ACH087**], Takiya [**ACH098**, **ACH103**], Angor, Dzhalpaktepa, Dzharkurgan). These indicate a dense population in the Sherabad Oasis in the later prehistoric to early medieval period. Many of these *tepa* are multi-period sites; some had lower settlements (*rabat*) and were surrounded by farmsteads. Some are located near modern settlements; some are in agricultural areas, where watercourses have moved over time or been diverted. Some, following abandonment as settlements, were used as cemetery sites in the medieval and post-medieval periods. Sites within c. 1km of the Project comprise:

  a. Koshtepa II [**ACH088**; State Register Archaeological Monument No. 354], a settlement mound (tepa) indicated on Soviet mapping, surrounded by irregular lower settlement (rabat) in the east. The lower half has been partly destroyed by ploughing and is partly covered with vegetation. Dated to the 4th century CE. Located approximately 1.1km northwest of 220kV proposed Transmission Line.

  b. Takiya [**ACH103**]. A settlement mound (tepa) north of the village of Takiya, marked on Soviet mapping as approximately 12m high. Sub-rectangular, settlement platform measures c. 120m x 100m. Well to east. Located c. 220m north of the Transmission Line.

- **Small, regular oval or circular mounds (labelled kurgan on historic Soviet mapping), some upstanding, and others levelled by ploughing.** These may be small house platforms or fortified farmsteads rather than burial mounds. These may have been in use for a shorter time that the larger tepa. Many of these sites have been levelled in the course of agricultural development. The purpose of such features can only be determined by field excavation. From west to east, sites within c. 1km of the Project comprise:

  c. A cluster of five mounds located between 130m and 500m west of the Solar Array site [**ACH054**, **ACH055**, **ACH056**, **ACH057**, **ACH058**]

  d. Mound site located c. 90m east of Solar Array site boundary [**ACH059**]

  e. Mound site located c. 1km northeast of Solar Array site boundary and 320m north of the proposed 220kV Transmission Line [**ACH060**]

  f. Mound site located c. 290m west of Solar Array site boundary [**ACH130**]

  g. Mound site located southeast of village of Talashkan, c. 500m north of Transmission Line [**ACH079**]

  h. Mound site located c. 500m south of Transmission Line [**ACH089**]

[108] Stančo, L (2009) The activities in Uzbekistan in the 2008 season: testing the Google Earth as a tool for archaeological prospecting. *Studia Hercynia* 13, pp. 115–122. Available at: http://arcis.ff.cuni.cz/activities-uzbekistan-2008-season-testing-google-earth-programme-tool-archaeological-prospecting#_ftn1
[109] Ibid.

i. Mound site located east of Sherabad Darya, c. 40m south of Transmission Line [**ACH125**]

- **Areas of former winter and summer pasture and settlement**, abandoned following the imposition of sedentary agriculture and the introduction of collective farming in the 1920s and 1930s and intensive farming in the 1970s and 1980s. The lower-lying steppe piedmont and plains north and west of the western end of the Transmission Line were historically used as the wintering place of semi-nomadic herders, noted on historic mapping[110]. The ruins of winter quarters and seasonal farmsteads [**ACH001**–**ACH046**] are located at the western end of the Project, located around the village of Talashkan. Ruins noted within 1km of the Project comprise:
  - Area of ruins (undated), c. 910m north of Solar Array site [**ACH005**]
  - Area of ruins (undated), c. 940m north of Solar Array site [**ACH006**]
  - Area of ruins (undated), c. 810m north of Solar Array site [**ACH009**]
  - Area of ruins (undated), c. 400m east of Solar Array site [**ACH012**]
  - Area of ruins (undated), c. 350m east of Solar Array site [**ACH013**]
  - Area of ruins (undated), c. 880m northwest of Transmission Line [**ACH038**]
  - Area of ruins (undated), c. 100m northwest of Transmission Line [**ACH039**]
  - Area of ruins (undated), c. 350m southeast of Transmission Line [**ACH040**]
  - Area of ruins (undated), c. 310m southeast of Transmission Line [**ACH041**]
  - Area of ruins (undated), c. 545m southeast of Transmission Line [**ACH042**]
  - Area of ruins (undated), c. 770m southeast of Transmission Line [**ACH043**]
- **Islamic cemeteries**, some of which may contain earlier burials or be located upon the remains of earlier *tepa* settlements. Cemeteries located within 1km of the Project comprise:

j. A small, recent cemetery surrounded by Solar Farm area but not within the Solar Farm boundary, c. 85m from the Solar Array site boundary [**ACH119**].

k. Takiya cemetery and mosque [**ACH099**; State Register Architectural Monument 224]. Possible underlying archaeological remains on west margin of the village of Takiya. Located c. 700m south of Transmission Line.

l. Cemetery and shrine, Hodzhanata [**ACH100**]. Located c. 700m north of Transmission Line.

Areas of archaeological potential

Archaeological remains within the PAI are likely to comprise:

- Surface finds scatters (struck stone tools, pottery, metalworking waste, ceramic building material) identified in areas of disturbed ground or in up-cast spoil from groundworks. If there are extensive erosion channels, these may also reveal surface scatters weathering-out/eroding from buried deposits.
- *In situ* surface finds scatters or features identified on bare ground.
- Landscapes of historic irrigation and cultivation.
- Buried or partially buried remains associated with historical upland grazing (particularly in the Solar Array area) and recent irrigated large-scale arable agriculture.
- Buried features, which may have Medium depth and complexity.

The visibility of archaeological sites may be hampered by burial under accumulated material dredged from irrigation canals and spread out over the adjacent ground surface, alluvial deposition from low moving rivers and palaeochannels, and wind-blown sand and loess deposits. It is estimated that these

[110] U.S. Army Map Service 1955, Termez, Western Siberia, Sheet NJ42-9 Series N502 (scale 1:250,000); Soviet military topographic map 1980 sheet J42-086 (scale 1:100,000 scale mapping)

may be over 2m deep in places.

Five areas of archaeological potential (AAPs) have initially been identified along the route of the Transmission Line. These are areas that are either known to contain, to be close to, or to have high potential for archaeological remains. These sites may require a specific staged programme of archaeological investigation and recording at construction stage, in addition to the generic measures such as watching briefs and management measures noted in Section 8. The significance of these areas and any other sites remains to be confirmed in the course of State Expertise. AAPs comprise:

- **AAP-A** – Area in vicinity of undated ruins **ACH039**, **ACH040**, **ACH041**, **ACH042**, **ACH043**;
- **AAP-B** – Area in vicinity of mound site **ACH079**;
- **AAP-C** – Area of archaeological potential in location of palaeochannels visible on satellite imagery;
- **AAP-D** – Area of archaeological potential in vicinity of mounds **ACH089**, **ACH125** and south of settlement mounds **ACH088** (Koshtepa II) and **ACH120** at Dzharty-Arky, at the confluence of the Sherabad Darya and a tributary; and
- **AAP-E** – Area of Archaeological Potential in vicinity of settlement mound **ACH103**, north of Takiya.

The location of areas of archaeological potential are shown on Figure 6-47 to Figure 6-51.

Figure 6-47. Location of areas of archaeological potential

Figure 6-48. Location of areas of archaeological potential: AAP-A & AAP-B

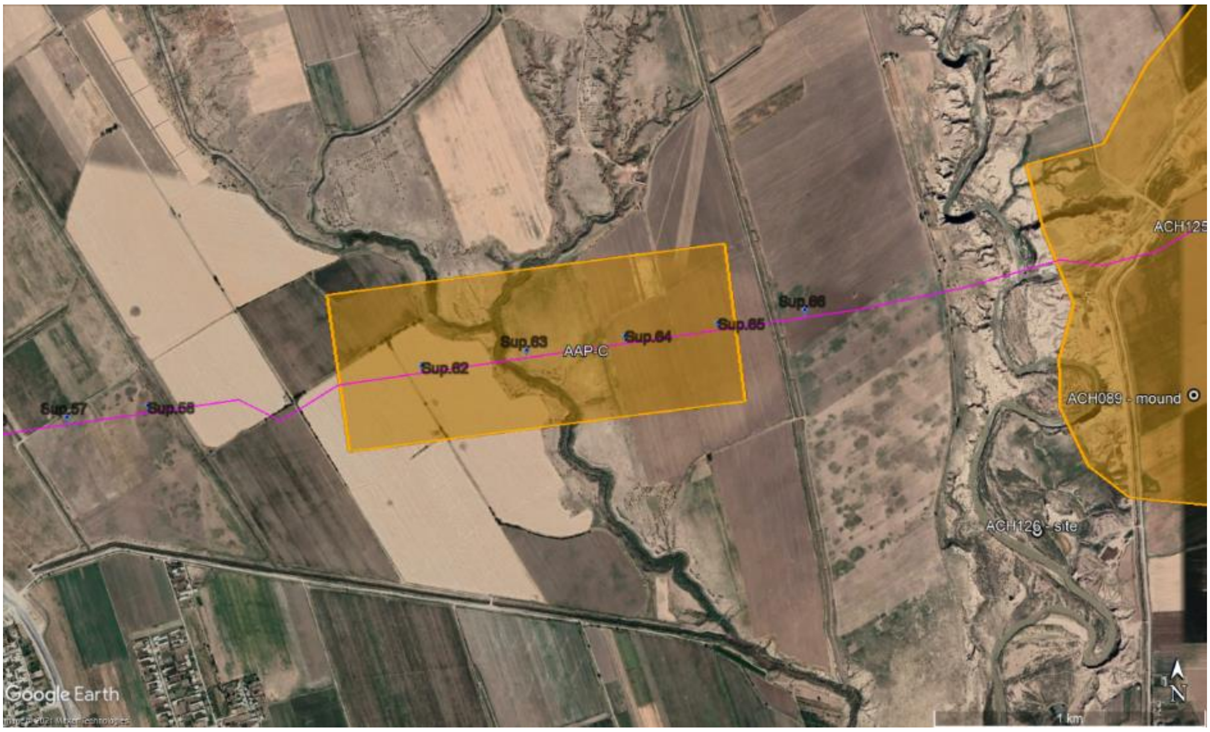

Figure 6-49. Location of area of archaeological potential: AAP-C

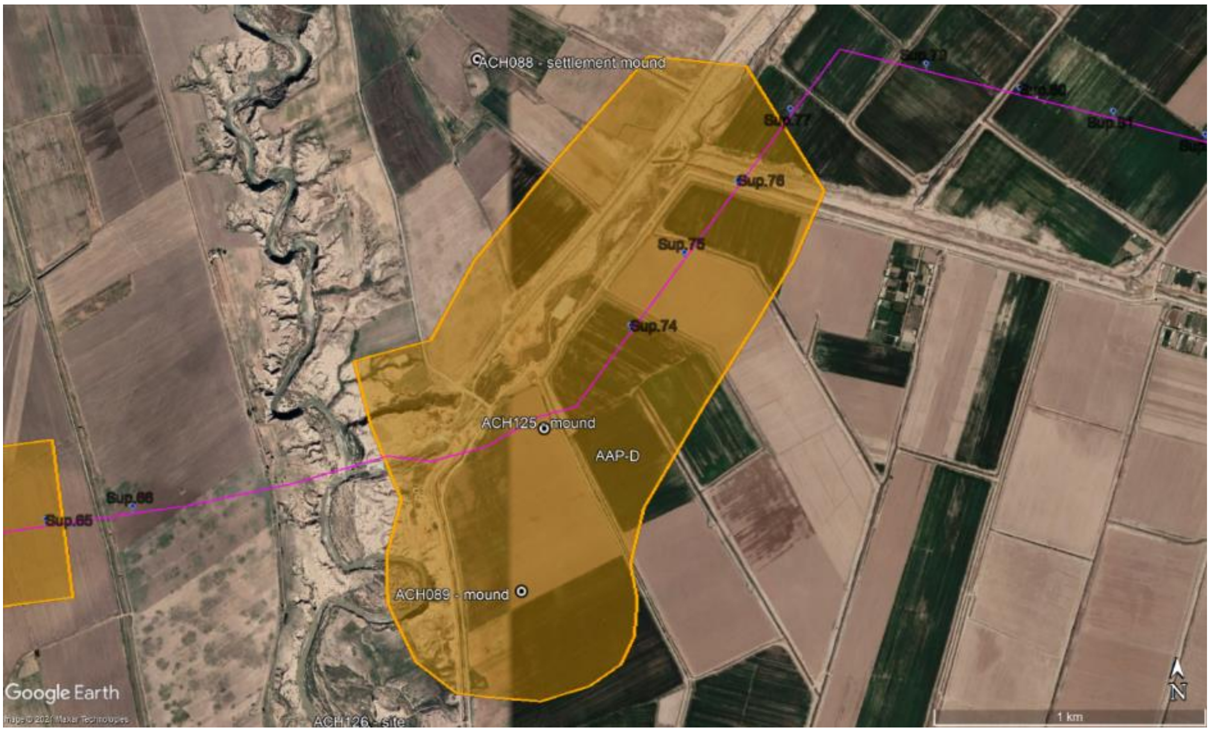

Figure 6-50. Location of area of archaeological potential: AAP-D

Figure 6-51. Location of area of archaeological potential: AAP-E

6.6.7.2 Natural Features and Tangible Objects with Cultural Values

Desk-based assessment and socio-economic field survey and interviews have not identified any unique natural features or tangible objects that embody cultural values, such as sacred plants, rocks and watercourses, within the site or in its area of impact.

6.6.7.3 Tourism

The Surkhandarya Region is in the process of developing tourism to attract local and foreign tourists. This includes developing cultural tourism, ecotourism, agriculture and pilgrimage tourism.

Cultural heritage sites with high tourism potential or priority restoration sites[111] in the vicinity of the Project include the 12th century Imam Abu Isa Muhammad At Termizi complex (Surkhandarya Regional List No. 29; State Register Site No. 406). Two sites in the area are on the priority restoration list, the 16th century Otaulla Said Vaqqos mausoleum (No. 197, Sherabad District) and the 18th century Khoja Samandar Termizi Mausoleum in Jarqurghon District (No. 208). All these sites are over 5km from the Project.

Other tourist attractions in the area include the Gazdagana Crater in the hills c. 12km west of the Solar Array site.

6.6.7.4 Intangible Cultural Heritage

Intangible cultural heritage is defined as the practices, representations, expressions, as well as the knowledge and skills (including instruments, objects, artefacts, cultural spaces), that communities, groups and, in some cases, individuals recognise as part of their cultural heritage. It is sometimes called living cultural heritage and includes oral traditions and expressions, including language; performing arts; social practices, rituals and festive events; knowledge and practices concerning nature and the universe; and traditional craftsmanship (UNESCO, 2003).

UNESCO Representative List of Intangible Cultural Heritage and Memory of the World Register

Uzbekistan's entries on the UNESCO Representative List of the Intangible Cultural Heritage (ICH) of Humanity comprise the art of miniature; Khorazm Dance; silk and textile production; Navruz (New Year) ceremonies; Palov rice dish traditions; Askiya, the art of wit; Katta Ashula traditional song; the shamanistic beliefs, Zoroastrian, Buddhist and Islamic traditions of the Boysun District; and the classical music tradition of Shashmaqom and the art of Bakhshi, the performance of epic poetry and song accompanied by traditional musical instruments[112]. Additional elements proposed for inclusion on the representative list of ICH include pottery, embroidery, carving and carpet making.

Uzbekistan's entries in the Memory of the World Register comprise the Archives of the Chancellery of Khiva Khans, the Holy Koran Mushaf of Othman and the Collection of the Al-Biruni Institute of Oriental Studies[113]. Elements proposed for inclusion on the UNESCO Memory of the World Register include al-Khwarizmi's *Brief Commentary on Astronomy*; Archives of the Bukhara Emirate; state foundation documents; cinematography of Khudoibergan Devonov and documents on evacuation to Uzbekistan during the Second World War.

It is not assessed that the continuation and transmission of any entries or proposed entries on the Representative List or the Memory of the World Programme would be impacted by the Project.

Local intangible cultural heritage activities

Uzbek crafts related to intangible heritage include silk production and weaving, rug and carpet-making and motifs; ceramics and varnished miniatures; wood-carving; metal chasing and embossing; silk and gold embroidery and tapestry; the Uzbek language; and culinary traditions. Regional crafts include embroidery and carpet weaving [114], and making traditional coats (*chapan*).

Religious practices in Uzbekistan are reported to comprise Muslim 96% (mostly Sunni of the Hanafi school), Russian Orthodox 2.5%, other 1.8% including small communities of Catholics, Protestants, Buddhists, Baha'is, Hare Krishnas, and atheists[115]. Uzbekistan has experienced a resurgence in religious practice since the 1980s, with increased activities of religious schools, neighbourhood mosques and religious orders which are controlled by the Muslim Board of Uzbekistan (the Muftiate). The surrounding area has a number of Islamic centres with their *maktabs* (primary schools) and *madrasahs* (seminaries) organised and supported by Muslim religious educators and their followers.

[111] Resolution of the Cabinet of Ministers No. 100 on Additional Measures to Develop Domestic and Pilgrimage Tourism. Appendix 1: Cultural heritage sites with high tourism potential, which are planned to create conditions for visitors. Available at: https://lex.uz/ru/acts/-5315060

[112] UNESCO Lists of Intangible Cultural Heritage and the Register of good safeguarding practices. Available at: https://ich.unesco.org/en/lists

[113] UNESCO Memory of the World Register: Uzbekistan. Available at: http://www.unesco.org/new/en/communication-and-information/memory-of-the-world/register/access-by-region-and-country/uz/

[114] Resolution of the President of the Republic of Uzbekistan. Decision No. PQ-4539 of 28 November 2019. On Additional Measures for Further Development of Crafts and Support of Craftsmen. Available at: https://lex.uz/ru/docs/-4622088

[115] USDoS (2020) Uzbekistan 2020 International Religious Freedom Report. United States Department of State, Office of International Religious Freedom. Available at: https://www.state.gov/wp-content/uploads/2021/05/240282-uzbekistan-2020-international-religious-freedom-report.pdf

Intangible cultural heritage activities in the PAI and immediate Study Area are assessed as being of local or regional significance. There are no associations with particular innovations, technical or scientific developments.

6.6.7.5 Critical Cultural Heritage

Critical Cultural Heritage is defined as internationally recognised or legally protected cultural heritage areas, including proposed World Heritage Sites, or the heritage of communities who use, or have used within living memory the cultural heritage (IFC, 2012).

The Project site itself does not contain any internationally recognised or legally protected cultural heritage areas.

The Silk Roads, a Tentative List World Heritage Site within Uzbekistan (Ref. 5500), broadly follows the course of the Zarafshan Valley.

Community Use of Cultural Heritage

The Solar Array site excludes an area near its centre which is currently used as a small cemetery and mosque [**ACH119**]. According to information gathered during the field visit, this is used by local people residential community association. Analysis of satellite imagery indicates that the site was developed between 2001 and 2010. Further details of this receptor are set out in Chapter 6.7, socio-economic.

Two further religious sites are located within 1km of the Project:

- Takiya cemetery and mosque [**ACH099**; State Register Architectural Monument 224]. Possible underlying archaeological remains on west margin of the village of Takiya. Located c. 700m south of 220kV Transmission Line.
- Cemetery and shrine, Hodzhanata [**ACH100**]. Located c. 700m north of 220kV Transmission Line.

There are a number of historic cemeteries at between 2km and 5km of the Project, north of the village of Boz Rabat [**ACH004**], at Besh-Kotan [**ACH047**], at Taskent [**ACH049**], at Yangiobod [**ACH050**], west of Balaylyk Tepe [**ACH051**], at Abdurachmanata [**ACH092**], at Dzarkurgan [**ACH113**, **ACH114**, **ACH115**, **ACH117**, **ACH123**]. The grave of Khodzha-Akkiyadaz, a shrine, is marked on Soviet mapping [**ACH052**].

Several mosques are also noted on historic and recent mapping, with examples at Urdaly [**ACH111**], Qiziriq [**ACH112**] and Dzharkurgan [**ACH122**].

Interviews with land users and local communities did not indicate any sacred sites in the vicinity of the Project.

Potential Significance of Archaeological Remains

No internationally recognised or legally protected cultural heritage areas have been identified within the Study Area. The Study Area has low potential to contain significant, stratigraphically intact archaeological remains. There is potential for surface remains in the form of findspot scatters and for remains to be well preserved below levels of intensive farming / land re-modelling within alluvial and colluvial deposits. Any remains present may have been impacted by agricultural ploughing, irrigation works and physical, climatic and chemical weathering. It is anticipated that any superficial or buried archaeological sites within the PAI are likely to be classed according to IFC criteria as ‘replicable cultural heritage’ (IFC, 2012), and can be mitigated by appropriate archaeological investigation, recording and dissemination.

Internationally Recognised Cultural Heritage Areas

World Heritage properties

Uzbekistan has four cultural properties inscribed on the World Heritage List, the Historic Centre of Bukhara, the Historic Centre of Shakhrisyabz, Itchan Kala and Samarkand – Crossroad of Cultures[116]. The nearest World Heritage Property is Shakhrisyabz, located over 150km north of the Project. These World Heritage properties are all distant from the Project and impacts upon their Outstanding Universal

[116] Uzbekistan Properties inscribed on the UNESCO World Heritage List. Available at: https://whc.unesco.org/en/statesparties/uz

Value have been scoped out.

Tentative List World Heritage Sites

A Tentative List is an inventory of those cultural and natural properties which each State Party intends to consider for nomination to the World Heritage List. Those in proximity to the Surkhandarya Region comprise:

- **Zarautsoy Rock Paintings** (Ref. 5299)[117]. The Zaraut-kamar Cave in Zarautsoy Gorge bears Mesolithic, Neolithic and Bronze Age rock art and medieval inscriptions, including images of hunters disguised as birds, archers and wild animals. Located c. 185km northwest of the Project.
- **Ak Astana-baba** (mausoleum) (Ref. 810)[118]. This is located near the village of Telpek-Chinar in a large ancient cemetery. The 10th to 11th century CE mausoleum was built in honour of Abu Khu-Khureyra who is considered an associate of the Prophet. Located c. 100km northeast of the Project.
- **Ancient Termiz** (Ref. 5298)[119]. Old Termiz is located c. 5 km northwest of modern Termez, on the right branch of Amudarya River. The 500ha site consists of a citadel (*qala*), two lower town areas (*shakhristans*) and suburbs (*rabat*), divided by the fortifications. The city was founded in the 4th to 3rd century BCE. The city settlement is formed by the fortress in the 3rd to 2nd century BCE. In the Kushan period, it was a large administrative and ideological centre of Northern Bactria. It had several Buddhist monasteries including Fayaztepa and Karatepa. It flourished in the 9th and 10th to early 13th century, being the largest trade and craft centre in Northern Toharistan. The city was destroyed by the Mongols in 1220. The city of Termiz is located c. 33km south of the Project.

  m. **Dzharkurgan Minaret** forms part of the Ancient Termiz Tentative List nomination. The brick minaret decorated with mosaic ties was constructed in 1108-1109 CE by the master architect Ali Muhammad Sarh, under Amir Khuroson's order, who subsequently become governor of Khuroson. Dzharkurgan Minaret is located c. 4.8km south of the Electricity Substation near the village of Minor.
- **Boysun cultural landscape** (Ref. 5300)[120] is located in the Gissar Mountains, and included in Boysun cultural reserve. Archaeological sites include Teshik-Tash, Kushan wall, Kurganzol. The indigenous population of Uzbeks and Tajiks have unique and distinctive traditions. The area also contains traditional villages, craft workshops, spa complexes and diverse flora and fauna. Boysun is located c. 60km north of the Project.
- **Silk Roads Sites in Uzbekistan** (Ref. 5500)[121]. Uzbekistan's Silk Roads facilitated trade in silk and materials such as precious metals and stones, ceramics, perfumes, ornamental woods, and spices in return for cotton and wool textiles, glass, wine, amber, carpets and horses. This trade was sustained by a system of caravanserais, commercial settlements, trade cities and forts, spreading ideas, scientific and technological developments. This is reflected in surviving monuments, sites and cultural landscapes. Ancient Termiz (see above) is included in this tentative listing.

The Project will not impact upon these Tentative List sites due to distance and intervening built form, modern intensive farming and existing power infrastructure near the substation. Potential harmful impacts from the Project on these Tentative List properties are therefore scoped out.

Legally Protected Cultural Heritage Areas

A full list of State Register sites on the Register of Tangible Cultural Heritage Properties located in Dzharkurgan, Kizirik and Sherabad Districts, Surkhandarya Region is reproduced in **Appendix B**.

No State Register sites have been identified within, or in the vicinity of the PAI.

[117] UNESCO World Heritage Centre – Tentative Lists. Zarautsoy Rock Paintings. Available at: https://whc.unesco.org/en/tentativelists/5299/
[118] UNESCO World Heritage Centre – Tentative Lists. Ak Astana-baba (mausoleum). Available at: https://whc.unesco.org/en/tentativelists/810/
[119] UNESCO World Heritage Centre – Tentative Lists. Ancient Termiz. Available at: https://whc.unesco.org/en/tentativelists/5298/
[120] UNESCO World Heritage Centre – Tentative Lists. Boysun. Available at: https://whc.unesco.org/en/tentativelists/5300/
[121] UNESCO World Heritage Centre – Tentative Lists. Silk Roads Sites in Uzbekistan. Available at: https://whc.unesco.org/en/tentativelists/5500/

6.6.8 Archaeology and Cultural Heritage Receptors and Receptor Sensitivity

Ground in low-lying areas is likely to have been disturbed by the excavation of ditches and canals, ground levelling and ploughing. Any surviving archaeological deposits may be buried under thick anthropogenic deposits. Surface findspots may be present where disturbed by ploughing or erosion. Unknown buried remains may be present within natural deposits (alluvium, colluvium) and beneath made ground.

The archaeological sites known from the wider Study Area are considered to be typical of the region. Some have been designated according to local, national or international standards in terms of their outstanding aesthetic, artistic, documentary, environmental, historic, scientific, social, or spiritual value. The assessment of the scientific value of any archaeological sites may change following the site visit, State Expertise and any intrusive investigation and recording work.

Intangible cultural heritage activities are assessed as being of local significance and no particular elements are designated or registered, and consultation has not indicated any associations with particular innovations, technical or scientific developments, movements or specific individuals of regional or national significance.

Livelihood issues related to traditional land use and land access are addressed in ESIA Chapter 6.7, Socio-economic.

6.6.9 Sensitivity Criteria

Receptor sensitivity is the degree to which a particular receptor is more or less susceptible to a given impact. Receptor sensitivity takes into consideration the receptor's resilience and value.

Receptor resilience or vulnerability describes the ability of the receptor to withstand adverse impacts. It takes into consideration activity-impact-receptor pathways, as well as environmental characteristics that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of 'vulnerable' to 'resilient', with the former more likely to experience significant impacts as a result of a given change.

Receptor value takes into consideration its quality and its importance as represented, for example, by its conservation status, its cultural importance and/ or its economic value. The evaluation of receptor sensitivity employs a qualitative scale of negligible, low, medium, and high for each of the sensitivity characteristics, resilience and value.

In the absence of any national or international consensus on archaeological impact assessment methods for non-designated resources, the criteria used to determine receptor sensitivity, magnitude, nature and significance of impacts on cultural heritage are based on the International Commission on Monuments and Sites (ICOMOS) 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)[122]. It is acknowledged that this contains much reference to World Heritage, but the assessment tools contained in its appendices are applicable to all cultural heritage assets.

None of the sites or objects identified in this ESIA have been previously recorded or designated, so there are no assigned national designation rankings to apply. The sensitivity of an archaeological or cultural heritage receptor also reflects how vulnerable or robust a site, monument, artefact, assemblage or complex is to damage or destruction by a number of factors, including:

- Natural conditions, such as erosion, flooding, wave movement and chemical deterioration.
- Environmental conditions, such as faunal and floral impacts.
- Human conditions, such as vandalism or interference, recreational use, vehicular damage.
- Project-related conditions, including construction and operational impacts.

The assessment of heritage value with regard to research agendas is important in establishing the significance and value of archaeological remains. The value of archaeological remains and sensitivity of archaeological sites, monuments and artefact find-spots is judged upon the extent of survival, their

[122] ICOMOS 2011 [under review] Guidance on heritage impact assessments for Cultural World Heritage Properties. International Council on Monuments and Sites. Paris. Available at: http://openarchive.icomos.org/266 /

current condition, rarity, representativeness, the importance of the period to which the remains date, fragility, connection to other monuments (group value), potential to contribute to knowledge, understanding and appreciation, potential for future research, the values assigned by local experts and the extent of documentation enhancing the monuments' value.

Table 34 presents the sensitivity criteria specific to the archaeology and cultural heritage study.

Table 34. Archaeology and cultural heritage sensitivity criteria

Sensitivity	Criteria
High	Sites of acknowledged international importance inscribed as World Heritage Sites. Individual attributes that convey Outstanding Universal Value. Nationally-designated archaeological monuments, sites, buildings or historic landscapes protected by national laws. Undesignated sites, structures or historic landscapes of demonstrable national value. Assets that can contribute significantly to acknowledged national or international research objectives, whether designated or not. Well or extremely well preserved historic landscapes with considerable or exceptional coherence, time-depth, or other critical factors. Intangible Cultural Heritage inscribed on national registers, or associated with movements or individuals of national or global significance.
Medium	Designated or undesignated sites, landscapes or seascapes that can contribute significantly to regional research objectives. Designated or historic buildings that have exceptional qualities or historical associations, with important historic integrity and contributing significantly to historic character. Designated or undesignated historic landscapes or seascapes of regional value, which would warrant designation. Intangible cultural heritage areas in local registers, or associated with movements or individuals of local importance.
Low	Designated or undesignated assets of local importance. Assets compromised by poor preservation and/ or poor survival of contextual associations, or with little or no surviving archaeological interest. Assets with potential to contribute to local research objectives. Historic buildings of modest quality in their fabric or historical associations, or buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Undesignated historic landscapes or seascapes with importance to local interest groups, whose value is limited by poor preservation and/ or poor survival of contextual associations. Landscapes or seascapes of little or no significant historical interest. Intangible cultural heritage activities of local significance or associated with individuals of local importance. Poor survival of physical areas in which activities occur or are associated. Areas with few intangible cultural heritage associations or vestiges surviving.
Negligible	Assets with little or no surviving archaeological interest. Buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Areas with few intangible cultural heritage associations or vestiges surviving.
Unknown	The importance of the resource cannot be ascertained.

Source: ICOMOS, 2011

6.6.10 Receptor Sensitivity

Table 35 presents the level of sensitivity for each receptor identified.

Table 35. Assessed sensitivity of archaeology and cultural heritage receptors

Receptor	Sensitivity
Tangible cultural heritage Any archaeological sites identified by the State Expertise	Presently unknown, anticipated to be low

Natural features/ tangible objects with cultural values Islamic cemetery **ACH119**, located adjacent to the Solar Array, is a community asset of high sensitivity.	High
Intangible cultural heritage Cultural knowledge, living traditions & religious practices e.g. activities and transmission of practices related to shrines, cemeteries, healing springs, farming practices; local crafts. These are considered to be resilient to the Project impacts.	Medium

No archaeological remains have been identified within the Solar Array site or Transmission Line route. The Project has not yet been subject to State Expertise, which will extend across the Project footprint and note any significant sites within it. It is anticipated that past ploughing and irrigation works may have truncated the upper levels of deposits. For this reason, these receptors are assessed as being of low (local) importance.

The sensitivity of any currently unknown archaeological remains that may survive within the Project Area cannot be accurately determined at the time of writing. Their sensitivity would be derived from their potential to contribute to scientific understanding of past human activities and environments. However, based on the likely level of preservation of any remains and the condition of known remains from the wider area, it is assessed that their sensitivity would be low.

Local intangible heritage practices include farming, herding and crafts. These have strong administrative support and are considered to be resilient to the development. It is assessed that the Project will not impact upon the fabric, use or transmission of practices associated with shrines or cemetery sites.

No internationally recognised or legally protected cultural heritage areas have been identified. It is anticipated that any superficial or buried archaeological sites within the Project Area are likely to be classed according to IFC criteria as 'replicable cultural heritage' (IFC, 2012), and can be mitigated by appropriate archaeological investigation, recording and dissemination.

6.7 Socio-economic Conditions

6.7.1 Introduction and Methodology

Social impacts are defined as *"the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society*" (ICGPSA, 1994). To understand the full extent of any social impacts arising from the Project, directly or indirectly, a detailed socio-economic baseline is required to appreciate current socio-economic conditions and therefore accurately assess the significance of any anticipated impacts, positive or negative. The baseline also helps to determine what mitigation measures (which aim to reduce the significance of negative impacts and enhance the significance of positive impacts) can be feasibly implemented within the Project's socio-economic context.

Additional baseline data will be gathered during the impact assessment phase to compile a more comprehensive description of social conditions of the communities within the Projects' Area of Influence (AoI). In order to provide socio-economic context, statistics and other summary information will also be provided for Uzbekistan as a whole.

Further work has been completed through the Livelihood Restoration Plan (LRP). In support of this study, detailed socio-economic surveys have been undertaken and are included in the LRP

6.7.2 Socio-economic Area of Influence

The Social Study Area, or AoI, will focus on the Project Site, as defined in Section 2.1. For the purpose of characterising other potential direct and indirect socio-economic impacts to surrounding communities, in accordance with IFC guidance (see Section 3.5.1), the Study Area will also extend to 2 km from the perimeter of the Project Site to encompass nearby communities who may feasibly be impacted by the project's construction, operation and decommissioning activities. A Study Area has been set for the OHTL at 64 m to coincide with the Sterilization Zone.

Although the focus of the baseline study is the Project site and surrounding communities, some national and regional level baseline information may also be included to provide a wider socio-economic context.

6.7.3 National and Regional Development Context

The Republic of Uzbekistan is a landlocked country in Central Asia and was formerly a part of the Union of Soviet Socialist Republic until it declared independence in September 1991. The country occupies a total of 448,900 square kilometres and shares borders with five other countries: Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan.

As of 2020, the estimated total population was 34,232,050, just under 50% of whom live in rural areas (WBD, 2021). Uzbeks account for 83.8% of the population, while other ethnic groups such as the Tajiks, Kazakhs, Russians, Karakalpak, Tartars comprise the remaining 16.2% (CIA, 2021). Uzbek is the only official and most widely spoken language in the country, spoken natively by approximately 85% of the population. Russian has widespread use as an inter-ethnic communication language and as a language of governance. Other ethnic languages spoken in the country are Tajik, Kazakh, Tatar, Kyrgyz. and others. In terms of religious faith, 88% percent of the population are Muslim (primarily Sunni), 9% are Eastern Orthodox Christians and 3% are of other faiths.

Economically, Uzbekistan is a major producer and exporter of cotton and, with a large capacity for power-generation from the Soviet era and an abundant supply of natural gas, the country has become the largest electricity producer in Central Asia. Having a large supply of liquid assets at its disposal has resulted in high economic growth and low public debt (Brookings Institute , 2019). However, the country's GDP per capita remains relatively low, at USD 7,378 compared to other economies in the region such as Kazakhstan (USD 26,728), Turkmenistan (USD 16,195), and Azerbaijan (USD 14,452).

The Republic of Uzbekistan consists of the Republic of Karakalpakstan, 12 regions, 120 cities, 113 towns, 164 districts, and 11,844 rural settlements. The population is densest in the southern and eastern regions of the country near the capital, Tashkent. The population to the northern and western regions, around the Republic of Karakalpakstan is sparser (Bektemirov and Rahimov , 2001).

The system of public administration in Uzbekistan is comprised of two tiers, central and local. Local governments are subdivided into regional, district and city administrations. In addition, community self-governments also operate locally, although they are not part of the central public administration system.

6.7.4 Local Governance and International Structure

The project site is located in the Surxondaryo Region of Uzbekistan, which encompasses 14 administrative districts and has a population of over 2.5 million. Of this population, an estimated 64% lives in rural areas (UNDP, 2019). The total area of the region is 20,099km^2. The regional capital is Termez with a population of 122,9000. The project site sits within the Sherabad district which has an estimated population of 193,365 people and a total area of 2,620km^2 (State Committee of Statistics in Uzbekistan , 2020).

6.7.4.1 Formal Governance Structures

At both the regional (or *oblast*) and district (or *raion*) levels local governance is divided into:

A. **Local state administration**, which acts as an administrative body, the heads of which are appointed by the central government and are subject to formal approval by the corresponding local councils. The president appoints regional governors, who in turn appoint district and city/town governors that come under regional subordination. The district and city governors are accountable to the regional governor, who in turn is accountable to the president; and,

B. **Elected local council**, which acts as a legislative body, the representatives of which are appointed/elected for a period of five years. These administration levels represent the executive and regulatory bodies of the state at the regional and district levels, implementing the policies of central government in the provinces.

At the sub-district level there are Makhalla Committees which act as governance institutions in towns and rural areas. Makhalla Committees are salaried state officials and as such are answerable to the local state administrators as they are fully dependent on their funding (Urinboyev, 2018). Article 105 of the Constitution of the Republic of Uzbekistan recognises Makhallas as self-governing bodies whose role is to govern at the local level and oversee activities which include, but are not limited to:

Development of infrastructure.

Administering social welfare programs (e.g. provision of social aid to low-income families).

Ensuring security and order.

6.7.4.2 Informal Governance Structures

In addition to the formal Makhalla Committees, informal/social Makhallas often operate in parallel. The key difference between these institutions being that the leaders of the informal Makhallas are volunteers and are elected by local residents, hence they are regarded as community-led, self-governing institutions.

The project area belongs to Bog'obod Makhalla of Sherabad District. Bo'gobod makhalla extends to the north and north east of the project site. Towards the south and west of the project site is Musrabad District, specifically Yangi er, Tong Yulduzi, and Mehrgiyoh Mahallas (AECOM, 2021).

6.7.5 Demographic Profile

Regionally, the Sherabad population amounts 193,200 people (98,000 males and 95,200 females) consisting of 44,439 families who live in 34,364 households. There are 630 poor families registered in the district (Suntrace, 2020). Majority, 94.7% (178,700) of people are Uzbeks, 3.7% (7,100) Tajik, 0.9% (1,600) Turkmen, 0.1% (236) Russian, 0.1% (196) Tatar and 0.5% (903) other nationalities and ethnicities (Suntrace, 2020).

Ethnic groups living in the country have equal access to all social and other services, including health, education, and water and sanitation. None of the groups are socially excluded either from a legal standpoint or in terms of their actual situation. Further, no ethnic groups maintain cultural or social characteristics separate from the mainstream Uzbekistan society that would classify them as ethnic minorities. Therefore, based on the information obtained during the site visit and stakeholder engagement, there it is understood that there are no indigenous people living in the region that meet ADB criteria:

i. self-identification as members of a distinct indigenous cultural group and recognition of this identity by others.

ii. collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories.

iii. customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and

iv. a distinct language, often different from the official language of the country or region.

The project site is territorially related to the rural gathering of citizens "Gulbakhor", the citizens community union "Mehrigiyo" of Sherabad district. The wider project area is bordered by rural settlements / citizens community union of Baikishlak and Pakhtaabad in the south, Yangiyer, Talashkan, Beshkurgan in the east and Navbahor in the west (Suntrace, 2020). The project site is located 18 km south-west of Sherabad city (Suntrace, 2020).

6.7.6 Land Regulations and Use

6.7.6.1 Land Tenure

The legal foundation for all land tenure in Uzbekistan is contained in three key documents:

- The Constitution (1992, Article 55).
- Civil Code (1997, Head 8, Head 13, and Head 17).
- The Land Code (1998, Head 4).

Exclusive state ownership of land was first incorporated in the 1992 Constitution; hence land is the only productive asset that cannot be privately owned in Uzbekistan. The Land Code stipulates that land is a state-owned national treasure to be used in a rational manner and it is protected by the state as a base of life, activities and welfare of the population (Land Code of the Republic of Uzbekistan , 1998). However, lifelong inheritable land tenure is available to Uzbek citizens but only in the following cases:

- Dehkan farms (individual or family farms).
- Individual homestead construction and household operation.
- Collective orchards and vineyards.

Furthermore, land plots can be provided to legal and physical entities for a continuous, long-term, or temporary tenure and use. This is usually for agricultural or forest land, as per Head 4, Article 20 of the Land Code (1998). Land plots are usually leased to citizens and legal entities by mayors (or *hokims*) of districts, towns, and cities. However, if any foreign element is involved, the central Government of Uzbekistan must be the leasing entity, as per Head 4, Article 24 of the Land Code (1998).

Users pay for the use of the land in the form of land tax. Under Head 4, Article 24 (1998) of the Land Code it is not permitted to sublease the leased land plot as a whole or even part of it. This provision further stipulates that leased land plots cannot be sold and purchased, cannot serve as collateral, and cannot be donated or exchanged. A specific form of subleasing, “intrafarm leasing”, is permitted only to worker families within a *shirkat* (former collective farms).

For private farms land is usually leased for approximately 30 years but can range between a minimum of 10 years and a maximum of 50 years. Farms are subject to some state interventions (e.g. quotes for the production of cotton and wheat) but for the most part they are governed by local authorities (or *hokimiyat*). Hokimiyat may cancel leases for various transgressions, usually if the leaseholder fails to comply with the contract terms (e.g. the cropping plan).

Most land around the project site is organized under the Dehkan modality. Dehkan farms are rural household producers operating on small household plots received on lifetime inheritable tenure rights. Dehkan farms are numerous and are considered to be very important as they satisfy basic needs of the large rural population including food, employment, income. Dehkan farms tend to specialize in vegetables, fruit, meat, milk, eggs and other animal related products. Dehkans often work for private farmers – for cash or on the basis of a sharecropping agreement (dehkans receive a percentage of the yield) (Melnikovová, L., & Havrland, B., 2016).

6.7.6.2 Current Land Use in the Project Area

Between the 21st to the 24th of October 2021 a site walkover was undertaken by AECOM to gain a greater understanding of the project area and those affected by the solar development (AECOM, 2021). The walkover revealed that there is one informal farming household (Farmer 1) active in the area. Farmer 1shas held land (5.9 ha) adjacent to the project area since 2014. He has a fishery farm, two shelters (10 m from the eastern project border), a container, sheep pen, and a water container (which is currently located within the project area). He also has a winter house within the project area, near the brick plant in the southeast border of the project and grows wheat on two hectares of the land which is leased by another household (Farmer 2). Since this walkover, the project boundary has been adjusted to avoid the winter house and farmland of farmer 1

Farmer 2 has a leasehold of 8 ha of land since 2018 within the eastern part of the project area. He is yet to use the land and plans to invest in water channel before starting to captivate the land.

Further studies carried out as part of the LRP process identified another leaseholder (Farmer 3) in the western part of the site, the farmer does not use this land and has more productive land with a pomegranate orchard elsewhere.

The site territory is located on the desert steppe in the middle of agricultural lands, with a predominantly grey soil type. The area is used primarily for livestock grazing in springtime. In the eastern part of the site, tamarisk bushes grow in one wide strip. These bushes are actively cut down by local people for firewood. Camel thorn is also grown abundantly in the area surrounding Farmer 1’s land, which is indicative of overgrazing.

There is evidence of historic land cultivation and an old water channel in the western site, it is estimated that this was last active approximately 30 years ago. On the eastern side of the site there is an abandoned water well, sheep barn, farm buildings, and water collectors. Local land users informed the ESIA Consultants that these structures have been abandoned since Soviet times.

There is an active cemetery belonging to Muzrabad makhallas located in the western site. The cemetery has administrative building and prayer place near the cemetery.

Figure 6-52. Cemetery in the centre of the project site

Figure 6-53. Prayer area attached the cemetery in the middle of the project site

Suntrace (2020) also undertook a study of the land use in the communities surrounding the project area, of which the findings have been reported in Table 36.

Figure 6-54. Project Site and its Surroundings (to be updated)

Table 36. Land Use and Livestock in Affected Villages

Villages along the transmission line	Wheat (ha)	Orchards (ha)	Other land pasture (ha)	Irrigated land (ha)	Dry land (ha)	Fallow land (ha)	Horses	Sheep/ goats	Cows
Oyinli	1,350	177	0	4,045	0	0	6	3,520,	2,456
Oltinvoha	130	15	0	145	0	0	6	958	440
Qishloqbozor	558	51	117	1,128	0	0	7	2,649	793
Bogobod	1,100	68	382	1,800	0	0	0	2,352	1,100
Boyqishloq	630	10	0	1	0	0	4	1,900	1,100
Oqtepa	465	23	42	910	11	0	3	465	ND
Takiya	575	9	0	1,151	30	30	5	4,000	5,000
Yangi Obod	9	40	0	20	0	0	100	5,040	37,015
Navruz	99	3	0	137	0	0	4	2,800	980
Yangiobod	0	0	71	0	0	0	0	400	100
Qushteppa	230	80	16,000	575	16,000	0	0	3,120	1,230
Total	**5,145**	**477**	**16,612**	**9,911**	**16,041**	**30**	**135**	**27,249**	**50,224**

Source: Suntrace, 2020

6.7.6.3 Solar PV Site

The proposed solar PV site consists of 631 ha of land. The site is on an open, flat contiguous piece of unused land that is under Government ownership; the land will be allocated to Masdar for the development of the proposed project. There is limited vegetation within the solar site with the exception of small areas of scrub and ephemeral (fast growing) plants with long views to the horizon (*ibid.*). There are no habitations / settlements within the site; however there are small settlements of low density further down the road towards the south of the solar site. Nearby villages / settlements use the wider solar site area for pasture and grazing of livestock, with uncontrolled dumps of domestic and construction waste along the periphery of the site (*ibid.)*.

6.7.6.4 Current Land Use Under and Overhead the Transmission Line

The proposed alignment for the 220 kV transmission line will follow an existing 110 kV overhead transmission line transect across agro-landscapes (cotton, wheat and alfalfa fields, orchards, vegetable gardens), tree lines, roads and network of irrigation canals, households / settlements (total of 11 villages) and pastureland. The right of way (ROW) associated with the transmission line will cross the different habitats, cross the Karasu river (the width of Karasu river at the intersection of the line is approx. 12.4 meters). The final transmission line alignment will be optimised during the detailed engineering design.

Figure 6-55. General character of the transmission line route (Dec 2021)

6.7.7 Community Infrastructure and Resources

6.7.7.1 Housing

The United Nations Economic Commission for Europe (UNECE) found that rural households are typically larger than urban ones, averaging between 4.9 and 6 people, compared to 3.8 in the urban Capital City of Tashkent (UNECE, 2015). However, living space per person is found to be lower in rural areas of Uzbekistan (14.5 m^2 in rural areas and 16 m^2 in urban areas) (Ministry of Economy of the Republic of Uzbekistan, 2014).

The communities in the Project AoI are rural, each household plot typically consists of a detached house with an attached plot of land. Households typically accommodate several family generations living together. Many of these houses are self-built using available materials and therefore often fail to meet modern construction standards and lack important amenities (see Figure 6-56 and Figure 6-57 for examples of houses close to the project area). In the wider Sherabad district Power supply is available in 99.4% of households including rural area and natural gas in 16.6% of urban district households. In-house water supply is available to 36% of the households (Suntrace, 2020).

Figure 6-56. Farmer 1 House

Figure 6-57. House South of the Project Site

6.7.7.2 Community Services and Facilities

AECOM gathered information on community facilities during the Dec 2021 site visit. The main facilities were identified as:

Bog'iobod Mahalla

- Mahalla has one school No. 41 (900 pupils, 150 teachers and other personnel), and two kindergartens.

Yangi Yer Mahalla

- School No. 47 has 250 pupils and 35 staff.
- Mahalla administration is located in village Guldiyer, further away from the Site. That village has feldsher clinic, police station, ambulance.
- Hospital in Mehrgiye.

Yulduzi Mahalla

- Two schools (no. 42 and 52), total 670 pupils and 100-120 staff.
- Feldsher clinic, 4 doctors, 8 nurses. There are some local private health clinics.
- Mahalla does not use the Site.

6.7.7.3 Utilities

Access to electricity is nearly universal across Uzbekistan as most people are connected to the national grid.

Bog'iobod Mahalla has water supply to the streets for drinking purposes. In 2022 there should be some works carried out to install water supply in houses, as part of the governmental program. There is a lack of irrigation water.

Propane gas bottles are generally used for cooking.

Table 37. Households with access to centralised water supply and sewage facilities in the Surkhandarya region

Region	Access to a centralised water supply (percentage of households)	Access to sewage utilities (percentage of households)
Surkhandarya	23.9%	72.5%

Source: State Committee of Statistics in Uzbekistan, 2020

Table 38. Access to utilities in urban and rural areas in Uzbekistan (2013)

Utilities	Percentage of rural households with access (%)	Percentage of urban households with access (%)
Water Supply	50.3	82.8
Sewage	8.9	53.9
Heating	25.8	59
Hot Water	5.5	45.4
Natural Gas	72.1	87.5

Fixed Telephone Line	14	57

Source: State Committee of Statistics in Uzbekistan, 2020

6.7.8 Community Health

According to the World Bank and national statistics, life expectancy at birth has continuously been increasing in Uzbekistan, from 58 in 1960 to 71.725 in 2020 (World Bank, 2021b). Table 24 shows how life expectancy varies depending on sex and location. Generally, women live longer than men and those in urban areas live longer than those who live in rural areas.

Table 39. Life Expectancy at Birth by Sex and Location

Total		Urban		Rural	
Female	Male	Female	Male	Female	Male
74.9	71.1	77.1	71.8	74	68.5

According to a review by the Food and Agricultural Organisation (FAO) Gender Country Assessment there have been significant improvements in the rural population's access to healthcare, maternal and child healthcare, and reproductive healthcare including access to contraception (Food and Agricultural Organisation, 2019). However, there are still some key health challenges in Uzbekistan, namely the prevalence of non-communicable diseases, which is largely attributed to consumption of tobacco, alcohol, poor nutrition and lack of physical exercise. The burden of non-communicable diseases is serious in terms of socio-economic development because such diseases can *"result in reduced income, early retirement, decreased productivity and employee turnover, with further implications for social protection costs"* (UN and Government of the Republic of Uzbekistan, N.D).

6.7.9 Economy and Employment

6.7.9.1 Economy

The World Bank classifies Uzbekistan as a lower middle-income country because its Gross National Income (GNI) per capita is between USD 1,026 and USD 3,995 (World Bank, 2019).

According to the International Monetary Fund, in 2019, the Gross Domestic Product (GDP) of Uzbekistan was at $60.490 billion USD (IMF, 2019). The national GDP composition by sector of origin is split between agriculture (28.1%), industry (36.4%) and services (35.5%). Comparing the changes in the structure of the economy between 2017 and 2019 shows a 30% increase in the share of the industrial sector and a decrease of 28.1% in the share of agricultural sector.

6.7.9.2 Livelihoods

In recent years, national statistics have shown an increase in the proportion of the population who are unemployed, increasing from 4.9% to 5.2% between 2009 and 2016 and reaching 9.3% in 2018. Nationwide, the majority of the population (60.9%) are employed in the service sector, the agricultural sector also employs a significant proportion of the population (25.9%), and the industrial sector employs the smallest proportion of the population (13.2%).

In Surkhandarya 63.9% of the population was employed (State Committee of Statistics in Uzbekistan , 2020).

6.7.9.3 Poverty

Between 2010-2018, GDP growth in Uzbekistan was between 7.5% and 5.4% (World Bank, 2021b). This sustained growth was broadly inclusive leading to the increase of gross national income per capita to $1,550 and reduction of national poverty rate from 17.7% (2010) to 11.4% (2018) (ADB, 2019). In the Surkhandarya region during the past 10 years, the GDP growth rate has exceeded national levels at 8% annually (UNDP, 2019). Despite this pattern of growth, the Surkhandarya region remains the second poorest region in terms of per capita income, contributing only 4% to Uzbekistan's total GDP ($1.3 billion) (ADB, 2019).

6.7.10 Education

The World Bank indicates that the net enrolment rate of primary school age children in primary education in Uzbekistan in 2018 was 96.845% (World Bank, 2021b). Of all the pupils that enrolled 98.31% continued to the last grade of primary (ibid.). However, when analysed through a gender lens, this number is slightly higher for male students (97.560%) than for female students (96.152%) (ibid.).

At the secondary level over 4 million pupils are enrolled nationally, 48% of which are female (World Bank, 2021b).

At the tertiary level under 10% of the national Uzbekistani population has a higher education degree.

6.7.11 Transportation

As can be shown in Table 40 automobiles are the most commonly used means of transport in Uzbekistan. Their use has experienced a 78% increase since 2000. Railroad and air travel have also both increased during the 20-year time-frame – yet only slightly. However, the use of trolleybus, tram and metro have all decreased (-99%, -95% and -45% respectively).

Table 40. Passenger transportation by transport type in Uzbekistan (per million population)

	2000	2005	2010	2015	2019
Passengers transported, mln. persons	3,596	3,962	4,072	5,380	6,025
of which:					
railroad	14.6	15.1	14.5	20	22.9
automobile	3,285	3,796	3,962	5,293	5,915
trolleybus	77.1	16.8	1.6	0.8	0.7
tram	92.4	43.3	25.8	11	3.8
metro (subway)	125.7	89.9	65.6	52	79.2
air	1.5	0.9	1.9	2	3.2

Source: State Committee of Statistics in Uzbekistan , 2020

In light of the large population size and high number of road users, Uzbekistan has a relatively dense road network and an appropriate hierarchy of roads. Of the total 185,000 km of roads in the country, 42,654 km make up the core network, of which 98% are paved (ADB, 2016). This network can be grouped into the following categories:

- International (3,979 km)
- National (14,069 km)
- Regional (local) roads (24,606 km)

There is an additional 140,000 km of urban and rural roads, which are managed by city municipalities and local districts (ADB, 2016). The major road that provides access to the Sherabad region is the M39. The speed limit is generally 70 km/hr in towns and 100 km/hr on highways outside towns (OSAC, 2020).

Figure 6-58. Road network surrounding the project site

The site is divided by an asphalt branch road i.e., 500 ha west of the road and 100 ha east of the road; this branch road runs north to south through the site.

6.7.12 Vulnerable Groups

Vulnerable groups are those individuals or groups who may be directly and differentially or disproportionately affected by the Project's negative impacts and/or less able to participate in and benefit from the Project's positive impacts because of their disadvantaged or vulnerable status. This status may stem from ethnicity, property, level of income, economic situation, gender, language, religion, national or social origin, age, culture, literacy, physical or mental disability, and dependence on unique natural resources (IFC, 2021). Based on the above definition, the following groups within the Project social area of influence are considered vulnerable:

- Young families (where the parents are under 30) who have lost both parents
- Children and young people
- Families with disabled parents or children
- A widow
- A single parent family
- A single retired person
- An elderly person (over 65 years old)
- Women in the family
- Anyone farming or investing in the land without a legal title
- People in poor health
- Households under the poverty line
- Households in financial difficulty
- Households with a member who is addicted to drugs or alcohol

These categories should however be used as a guide and it is possible that some people may be vulnerable because of very specific circumstances which might not fit into the above list.

A more detailed vulnerability analysis among project affected people, is included in the LRP.

6.7.12.1 Gender

Although women should not inherently be considered vulnerable in every project context, it is important to recognise and understand the challenges women face in Uzbekistan in order to accurately assess the impact the Project may have and proactively manage these risks in a pragmatic and effective way.

At the national level there are still some key challenges to gender equality, including a high prevalence of gender-based violence (GBV) and in particular, domestic violence; gender disparities in higher and technical education; and a high female unemployment rate accompanied by a low proportion of women in leadership positions (UN, 2020). This is particularly an issue for rural women in Uzbekistan who, according to the FAO (FAO, 2019), have very limited opportunities for employment outside of agricultural work and are overrepresented in informal employment markets. For example, women's labour in the agricultural sector tends to be low-skilled manual labour, and seasonal/temporary work not covered by a written contract.

When women work informally on dehkan frams, they do not receive protection under labour law in terms of social benefits, making them more vulnerable to exploitation. As formal farm owners and managers, women represent only around 4% of the heads of private farming enterprises across the entire country. There is no data available on the proportion of women heading dehkan farms, but since a very small number of women are heads of household, they are unlikely to be the formal heads of dehkan farms. Still, women contribute significant labour on dehkan farms, and, in migrant households, they can be the de facto farm managers.

In addition, Uzbekistan has also taken significant steps to improve women's prosperity in the world of work, however, gender pay gaps remain significant (ILO, 2020b). Table 41 shows a clear disparity between male compared to female labour activity rates, with females 26% less active than their male counterparts (Lloyds Bank Trade, 2021). While the Uzbekistan Government place emphasis on the rhetoric of women's rights and importance of women in the workplace, many women in Uzbekistan still are held to traditional roles of unpaid childcare and household work. Only a few women work in government and other governing bodies (Saferworld, 2021). While in 2019 the Uzbekistan government established the first ever gender equality law "Guarantees of Equal Rights and Opportunities for Women and Men"; these issues are likely to persist for years into the future while cultural opinions and values shift towards a new rhetoric.

Table 41. Ratio of male to female active population in Uzbekistan

	2017	2018	2019
Total activity rate (%)	65.26	65.25	65.19
Male activity rate (%)	78.39	78.48	78.50
Female activity rate (%)	52.31	52.19	52.05

Source: Lloyds Bank Trade, 2021

6.7.13 Community Security

Since President Shavkat Mirziyoyev came into power in 2016, there has been a marked shift in Uzbekistan's approach to citizen safety and security through several government reforms, including those mentioned in Section 6.8.2 in relation to forced labour (Saferworld, 2021). Despite these reforms there is still an embedded lack of trust between the police and public. For example, it was reported that in many regions of Uzbekistan, communities are reliant on the mahalla institution to prevent crime and enforce public order, rather than the police (Saferworld, 2021).

The Uzbekistan State Committee for Statistics released crime statistics for 2007, in which a total of 78,044 incidents were reported (see Table 42). The state committee Uzbekistan ranked 90th in the 2021 global organized crime index for criminality and was deemed a 'low criminality low resilience' country (Global Initiative Against Transational Organized Crime, 2021). It also ranked low in terms of drug trade

(103rd) but slightly higher for criminal actor organisations (76th) (Global Initiative Against Transational Organized Crime, 2021).

Table 42. Total number of crimes committed in Uzbekistan in 2007

	Female	Male	Total
Total number of crimes committed	11,527	66,517	78,044

Source: State Committee of Statistics in Uzbekistan, 2020

6.7.14 Potential Receptors

The baseline study has identified the potential socio-economic receptors that exist within the site and the project-affected communities. For the purposes of the assessment, potential receptors are defined as elements of the socio-economic environment which may interact with the Project activities or perceive an effect or change to their life conditions / quality of life as compared to their baseline characteristics, as discussed previously in this section. Receptors may be affected, directly or indirectly, positively or negatively, during the Project's construction, operations, and decommissioning phases. Table 43 lists the potential socio-economic receptors drawn from the baseline study.

Table 43. Socio-economic receptors in the project AOI

Receptor	Description
Project workforce	The construction workforce will either be based on site in a workers camp or within hotel or guest house accommodation in the nearby project-affected communities. Operational workforce will likely be housed within the project-affected communities as well. Associated risks of accident and ill health due to living or working conditions are relevant for this receptor, as well as their potential interaction with nearby communities.
Local economically active population	Project related employment and training needs may interact with the local economically active population. This receptor may encompass people living within the nearby project-affected communities.
General local businesses, services providers, and equipment suppliers	Project related procurement needs during the construction and operation phases may interact with local businesses, services providers and equipment suppliers (e.g., limited use of the local shops, procurement of equipment and materials supplies).
Communities	Project-affected communities to the north and south of the solar site who use the site for grazing.
Vulnerable groups	Groups with limited coping / adaptation capacities to external changes. Particular consideration is given to children, women and the elderly in the who reside within the project-affected communities. No indigenous peoples have been identified as part of the baseline study.
Livestock Keepers	Livestock keeping is one of the main sources of income for the project-affected communities and construction and operational activities may have an adverse effect on availability of livestock grazing, thus having a knock-on effect on income in the area.
Current Land Users	The acquisition of land in the project site will, if it hasn't already, physically and/or economically displace current land users. As per IFC guidance, regardless of their land tenure status these people are entitled to compensation and/or resettlement assistance.

6.7.15 Ecosystem Services

Under IFC's Performance Standard 6, Ecosystem Services are the benefits that people, including businesses, derive from ecosystems. Based on the framework used for the Millennium Ecosystem Assessment, Ecosystem Services are organized into four types (Millennium Ecosystem Assessment , 2005):

I. provisioning services, which are the products people obtain from ecosystems (for example these may include food, freshwater, timber, fibres, medicinal plants);

II. regulating services, which are the benefits people obtain from the regulation of ecosystem processes (for example, regulating services can be surface water purification, carbon storage and sequestration, climate regulation, protection from natural hazards);

III. cultural services, which are the nonmaterial benefits people obtain from ecosystems (for example, these could be natural areas that are sacred sites and area of importance for recreation and aesthetic enjoyment); and

IV. supporting services, which are the natural processes that maintain the other services (such as soil formation, nutrient cycling, primary production).

A baseline ecosystem services assessment of the project area was undertaken, which found that the solar PV site provides limited if any ecosystem services. The land has been degraded by past agriculture and now provides limited services other than some grazing.

More information about grazing and herding is discussed in section 6.7.6 and in the LRP. Impacts on herding and pasture land are assessed in section 7.1.8 and 7.2.9 and therefore a separate assessment on ecosystem services is not required.

6.8 Labour and Working Conditions

6.8.1 Labour Laws

The Labour Code of the Republic of Uzbekistan,1995 (as most recently amended in September 2017) is the main law governing working conditions in the Republic. The key points which are relevant to the current project are:

Chapter VI (Articles 4 and 72 to 76) determine the content, form and term of the employment contract, the limitation of rights of the employer to enter into a fixed-term employment contract, and the ratio of legal and contractual regulation of labour relations. This is relevant because there is no specific requirement to provide workers with documented information that is clear and understandable, regarding their rights, including their rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.

Article 77 determines the age at which employment is permitted (i.e., 16 years old).

Article 239 establishes that all persons under the age of 18 years shall be employed only after undergoing a preliminary medical examination and further until reaching the age of 18 are subject to mandatory annual medical examination.

Article 7 prohibits forced labour, understood as work performed under threat of punishment (including as a means of labour discipline).

Articles 211 and 212 establish requirements on labour protection, and the duties of the employee to comply with the norms, rules and regulations on labour and protection. The employee is obliged to comply with the norms, rules and regulations on labour protection, as well as the administration of the order of safe operation, use the obtained personal protective equipment, and immediately notify their supervisor (foreman, master, chief of a site, and others) if any accidents or situations that create a direct threat to human life and health occur.

Article 213 establishes the right of the worker to the information on occupational health and safety (OHS). At the conclusion of the employment contract and the transfer to another job worker shall be informed by the employer about working conditions, including the presence of risk occupational and other diseases due to him in connection with these benefits and compensation, as well as personal protective equipment. The employer must also inform employees or their representatives about the state of OHS in specific workplaces and production.

As of 1 September 2021, the minimum wage in Uzbekistan is UZS 822,000 a month (at the time of writing, this equates to approximately USD 77). In addition, employers are responsible for social security contributions. Their contribution must be up to at least 25 percent of the worker's salary.

6.8.2 Working Conditions and Forced Labour

The eradication of forced labour and child labour is an area that has reportedly been making significant progress Uzbekistan, with the government undertaking active measures to prevent the use of child labour (Human Rights Watch, 2020; The Cotton Campaign, N.D.; US Embassy in Uzbekistan, 2020). These measures include introducing criminal penalties for repeat violations of hazardous work prohibitions, doubling the number of labour inspectors, and conducting extensive awareness-raising on child labour laws and penalties for violations (US Embassy in Uzbekistan, 2020). The government also established a new National Commission on Combating Trafficking in Persons and Forced Labour and adopted a new roadmap to combat these issues (US Embassy in Uzbekistan, 2020). Historically, these issues were most prevalent in the agricultural sector, particularly cotton production, which according to the site visit, is the main land use just beyond the northwest boundary of the site.

In Uzbekistan, employment relations are overseen by statutory legislation or by collective agreements. The law in Uzbekistan considers the concerns and interests of workers, employers, and the state to maximise market functioning, working conditions are just and the rights of workers are protected.

There is currently limited information available on the working conditions in the construction sector in Uzbekistan. No further information is available from the Project Developer or EPC Contractor.

6.9 Transportation and Access

6.9.1 Introduction

It is currently assumed that the Solar PV components will be transported to site by rail to Tashkent from a manufacturing plant in China, via Kazakhstan, and from Tashkent by road to the site. The transportation method will need to be confirmed by the EPC contractor. Both options are described in more detail below.

- For conventional goods, the equipment that can be carried by railway containers is transported by railway containers; all goods are sent from the Xi'an Xinzhu Railway Port to Tashkent.
- Equipment that cannot be carried by railway containers (Box-type and HV transformers) will be exported via Khorgos Port to reach its destination by truck

6.9.1.1 Baseline Data Collection

A desktop review and site visits (undertaken in September and November 2021) have been undertaken to identify any key issues with regard to accessing the site and to consider potentially suitable access routes from an appropriate port or main road. This high-level route assessment was based on existing maps, satellite imagery and information gathered during the site visit.

There has been no data available to estimate the current national traffic volumes on the proposed roads to be used for transportation of materials on the site.

6.9.2 Baseline Conditions

6.9.2.1 Overall Transportation Route

The transportation study has considered a route from China where the parts will be delivered up to the Project site utilising the main transport network and avoiding built-up areas where possible.

The initial stage of the journey will be by train from the manufacturing sites in China to the Khorgas/Altynkol border crossing by Block Train then on to Tashkent. From Tashkent, material will be delivered to site by road.

Transshipment is required in Kazakhstan due to difference in track width between China & Kazakhstan. Transshipment will not involve the unpacking of containers / loads however it will take approximately 24 hours to tranship, arrange necessary documentation, arrange transit clearance, and shunting in/out of the terminal to the station.

The Chinese border crossing is located over 1,000 km east of the project site and it is key for importing and exporting goods in and out of inland central Asian countries, including Uzbekistan. The EPC Contractor will be required to confirm the suitability of the route and border crossing for delivering and handling the Project materials and, if necessary, propose an alternative route.

The Project site can be accessed directly from the minor road heading west from Shurcha via a short access road however a large part of the access from Shurcha is through local, unpaved roads.

Given the importance of the route for trade between China and Central Asian countries, and review of satellite images, the road infrastructure between the border and the site will be of good quality and should not present any significant technical difficulties.

The proposed rail and road route comprise the following key roads (distances noted are estimates):

- Travel by rail from Xi'an Xinzhu Railway Port to Tashkent Chukursay Station.
- From Tashkent, transfer goods to truck then join the M39 towards Chinaz.
- Continue west for 5km, bearing right to continue on the M-39.
- Continue on the M-39 but diverting south, west and north from Syrdarya to avoid crossing back into Kazakhstan before reaching Samarkand via Jizzakh – 150km.
- On reaching Samarkand turn onto the A738 then M39 and continue to Sherabad and from there to the village of Talashkan and on to the site.

Stopovers

A single stopover is planned between Tashkent and the site which is a distance of approximately 500km. For the transformers being transported by road from China to the site, a larger number of stopovers will be required and will be detailed further in the TMP.

6.9.2.2 Rail Transport

The railway shipments are all containerized. Goods will be loaded at the Xi'an Xinzhu Railway Station warehouse, China and the arrival point will be Tashkent Chukursay Station. The containers are then transported to the project site by road using customs supervision vehicles. The empty containers are returned to Tashkent.

The "Chang'an" train runs from Xi'an to Horgos Port, covering a total distance of 3,200km. It passes through three railway bureaus and 10 marshalling stations and arrives at Horgos Port within three days.

On leaving China, the railway transportation route is 1,600km in total, passing through four marshalling stations, the Kazakhstan Railway and Uzbekistan Railway - Almaty, Shimkent, and Tashkent. After reloading at Altynkol Station, the train reaches Chukursay station in Tashkent, where materials are then transferred by road to the Project site.

6.9.2.3 Road Description

It is proposed to follow the main highways from Tashkent to Sherabad then to site as highlighted below.

Figure 6-59. Transportation route from the M-37

Source: Masdar Transportation Study

M39 Highway

Part of the road was driven as part of the ESIA visit in both September and November 2021. However, it is understood to be dual carriageway in sections and is used by HGV traffic. It is deemed suitable to use for delivery purposes and can accommodate HGV traffic. The AECOM team drove the route from Jizzakh and it is noted that it may be more appropriate to use the by-pass to avoid travelling through Jizzakh *en route* to Samarkand. In either case, the road conditions are similar and the baseline conditions and impacts would be similar.

Figure 6-60. M39 west of Jizzakh

Figure 6-61. M39 west of Jizzakh (2)

Minor Roads close to the site

From Sherabad, the Project site is accessed via a minor road close to Talashkan. Further grading of this road may be required for larger vehicles to access the site. It is unlikely that the road will allow for vehicular travel faster than 40 km / hr. The road is generally wide enough to allow for two vehicles to travel in opposite directions although there are some pinch points particularly over canal crossings. The minor road dissects the Project site and provides access to the cemetery located in the centre of the site.

Figure 6-62. Minor road on the approach to the site

Site access

The site is proposed to be accessed from the minor road at Talashkan through the village. AECOM note that work may be required given the proximity of houses and services. The exact point of access will be confirmed by the EPC contractor. Once past the village, the site becomes open and expansive.

Figure 6-63. Access route on the northern side of the site

Figure 6-64. Access on the southern side of the site (cemetery in the distance)

6.9.3 Road Safety

Both Kazakhstan and Uzbekistan have relatively poor road safety records. According to the World Health Organisation (WHO) Road Safety Report, 2018[123], in 2016, there were 17.6 deaths per 100,000 population in Kazakhstan with the greatest proportion of these being drivers (60%) then pedestrians (31%). However, fatalities have more than halved in the past 10 years. In Uzbekistan, there were 11.5 deaths per 100,000 population which has increased slightly since 2007.

6.9.4 Roads Sensitivity Analysis

Table 36 sets out the level of sensitivity of the different sections of roads along the proposed route considering the type of road, current traffic volumes and the presence of any sensitive receptors.

Table 44. Sensitivity Analysis

Road	Receptor Details	Sensitivity
M39 (Uzbekistan)	Paved dual carriageway road with Medium daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Road suitable for and regularly used by HGVs	Low

6.9.4.1 Assessment Methodology

The assessment is based on the use of a number of different types of vehicles used during the construction and operation of the Project. These include:

- Light Goods Vehicles (LGVs) – contractors' vans, minibuses, private cars etc.

[123] World Health Organization (2018). Global Status Report on Road Safety 2018. Geneva: World Health Organization.

- Heavy Goods Vehicles (HGVs) – vehicles with a maximum rigid length of 12 m and a maximum articulated length of 16.5 m.
- Abnormal loads – vehicles over 25 m in length or 3.6 m wide.

6.9.4.2 Guidance

The assessment has been carried out using the IEMA (2003) “Guidelines for the Environmental Assessment of Road Traffic”. The guidelines suggest the following thresholds are adopted to assess whether particular links of the network are to be subject to assessment:

- Rule 1 – Include highway links where traffic flows will increase by more than 30 % (or number of HGVs increasing by more than 30 %).
- Rule 2 – Include any other specifically sensitive areas where traffic flows will increase by 10 % or more.

6.9.4.3 Assessment of Effects

The following sections set out the methodology which has been used to determine if the increased traffic flows during the construction phase of the Project are likely to be significant.

Sensitivity Criteria

The sensitivity of roads, their users and settlements along the proposed route has been assessed in accordance with the criteria set out in Table 37. The IEMA guidance details that sensitive locations are defined as receptors that are sensitive to traffic including amenities such as hospitals, places of worship, schools and historic buildings.

Table 45. Sensitivity Criteria

Sensitivity	Criteria
High	Large rural settlement containing numerous amenities. Traffic management measures in place such as controlled crossings, signalled junctions etc. Minor / unclassified unpaved roads with low traffic flow volumes. These may not be suitable for large HGV vehicles.
Medium	Rural settlement with a number of amenities. Minor traffic management measures in place. Local road (paved / unpaved) suitable for HGV traffic.
Low	Small rural settlement with few local amenities. Minimal traffic management measures in place. Paved road capable of large volumes of HGV traffic.
Negligible	Scattered dwellings with no local amenities. No / little traffic management in place. Highway suitable for all types of vehicles and volumes.

Magnitude of Change Criteria

The magnitude of impact on traffic flow is determined based on criteria set out in the IEMA guidelines. This is set out within Table 38 below.

Table 46. Magnitude of Change Criteria

Sensitivity		Criteria
High	Above 90%	Above 90%
Medium	Between 60% and 90%	Between 60% and 90%
Small	Between 30% and 60%	Between 30% and 60%
Negligible	Under 30%	Under 30%

Assessing Level of Effect

Using these definitions, a combined assessment of sensitivity and magnitude has been made to determine the level of the predicted effect on a receptor i.e. Negligible, Low, Medium of High. All direct and indirect impacts causing Medium or High effects are considered to be significant.

6.9.4.4 Assumptions

It is assumed for the purposes of this assessment (and forecasted levels of traffic) that construction will commence in 2022/2023. Should this not be the case, it is unlikely that the change in forecasted levels of traffic will be of such a level as to change the assessment outcomes. The calculations are also based on a 456.7 MW (AC) solar plant.

As the details of how road stone and other materials will be supplied are not known at this stage, it is assumed that the routing of all materials will follow the route identified in the section below, thus presuming a “worst-case” scenario.

The construction schedule will be defined by the EPC Contractor. The assessment is based on an assumed construction phase duration of around 12 to 15 months, taking consideration of potential delays in transportation of materials and weather conditions. It is also assumed that the Project will be constructed as one development rather than in a phased approach. The vehicle numbers and personnel requirements have been estimated based on these “worst-case” assumptions.

6.9.4.5 Traffic Generation

The Project will result in additional vehicles travelling to and from the site during construction. These will include heavy goods vehicles (HGVs) and light vehicles. Overall, the total number of vehicles required to travel to and from site is not expected to be significant. A worst-case scenario has been modelled where all materials are transported to site by road.

The first period of construction will be associated with the delivery of equipment to site and the construction activities that will be carried out on site. The second phase will involve set up and commissioning of all infrastructure and as such, this stage will have reduced vehicle requirements. The construction phase is expected to generate the traffic volumes detailed in Table 39 below. It should be noted that these traffic volumes are estimated by AECOM based on previous solar PV project experience and are to be confirmed once a construction strategy is available from the EPC Contractor.

This assessment is limited to the expected amount of HGV movements and construction staff transportation requirements. The HGV movements estimated peak is expected to last one month and to be 1,460 vehicles during this month. It is also likely that a larger bus would be provided for construction workers thereby reducing the number of vehicle movements. It is also considered that a large proportion of the staff will be accommodated at the workers camp, in the proximity of the project site.

Table 47. Estimated Volume of Vehicle Movements during Construction

Vehicle Type	Activity	Total Vehicle Movements
HGV	Delivery of materials, plant, containers, concrete, aggregate material and welfare facilities	12,060
LGV (people carrier up to 6 people)	Transportation for construction workers to site.	2,800

It should be noted that this does not include movements of any abnormal loads or specialist vehicles (bulldozers, cranes etc) to the Project site. The amount of construction workers being transported to site is based on a typical on-site presence of 20 project staff at any one time with approximately 115 to 900 contracted site staff needed for the installation of the modules and civil construction. A detailed assessment of vehicle movements should be provided in the TMP.

Construction times can be arranged to avoid local peak times and routing arrangements, particularly for HGVs to minimise potential impacts.

6.9.4.6 Assessment Methodology

The assessment is based on the use of a number of different types of vehicles used during the construction and operation of the Project. These include:

- Light Goods Vehicles (LGVs) – contractors' vans, minibuses, private cars etc.
- Heavy Goods Vehicles (HGVs) – vehicles with a maximum rigid length of 12 m and a maximum articulated length of 16.5 m.
- Abnormal loads – vehicles over 25 m in length or 3.6 m wide.

6.9.4.7 Guidance

The assessment has been carried out using the IEMA (2003) "Guidelines for the Environmental Assessment of Road Traffic". The guidelines suggest the following thresholds are adopted to assess whether particular links of the network are to be subject to assessment:

- Rule 1 – Include highway links where traffic flows will increase by more than 30 % (or number of HGVs increasing by more than 30 %).
- Rule 2 – Include any other specifically sensitive areas where traffic flows will increase by 10 % or more.

6.9.4.8 Assessment of Effects

The following sections set out the methodology which has been used to determine if the increased traffic flows during the construction phase of the Project are likely to be significant.

Sensitivity Criteria

The sensitivity of roads, their users and settlements along the proposed route has been assessed in accordance with the criteria set out in Table 48. The IEMA guidance details that sensitive locations are defined as receptors that are sensitive to traffic including amenities such as hospitals, places of worship, schools and historic buildings.

Table 48. Sensitivity Criteria

Sensitivity	Criteria
High	Large rural settlement containing numerous amenities. Traffic management measures in place such as controlled crossings, signalled junctions etc. Minor / unclassified unpaved roads with low traffic flow volumes. These may not be suitable for large HGV vehicles.
Medium	Rural settlement with a number of amenities. Minor traffic management measures in place. Local road (paved / unpaved) suitable for HGV traffic.
Low	Small rural settlement with few local amenities. Minimal traffic management measures in place. Paved road capable of large volumes of HGV traffic.
Negligible	Scattered dwellings with no local amenities. No / little traffic management in place. Highway suitable for all types of vehicles and volumes.

Magnitude of Change Criteria

The magnitude of impact on traffic flow is determined based on criteria set out in the IEMA guidelines. This is set out within Table 49 below.

Table 49. Magnitude of Change Criteria

Sensitivity		Criteria
Large	Above 90%	Above 90%
Medium	Between 60% and 90%	Between 60% and 90%
Small	Between 30% and 60%	Between 30% and 60%
Negligible	Under 30%	Under 30%

Assessing Level of Effect

Using these definitions, a combined assessment of sensitivity and magnitude has been made to determine the level of the predicted effect on a receptor i.e. Negligible, Low, Medium or High. All direct and indirect impacts causing Medium or High effects are considered to be significant.

Where the identified thresholds above are exceeded, the IEMA guidance sets out a list of effects which should be assessed. This includes:

- Accidents and safety.
- Driver delay.
- Pedestrian amenity.
- Severance.
- Air pollution.
- Dust and dirt.
- Ecological effects.
- Hazardous loads.
- Heritage and conservation.
- Noise.
- Pedestrian delay.
- Vibrations.
- Visual effects.
- A number of these effects are covered elsewhere in the ESIA and so those considered within this chapter include:
- Accidents and safety.
- Severance.
- Driver delay.
- Pedestrian amenity.
- Pedestrian delay.

Accidents and safety

IEMA guidelines do not recommend the use of thresholds for identifying significance of impacts due to numerous local causation factors involved in personal injury accidents. However, it is recognised that a significant increase in overall traffic volumes and abnormal loads may raise concerns over road safety. Therefore, measures to address road safety concerns will form a key part of the assessment methodology and development of mitigation options.

Driver delay

Driver delay occurs due to additional traffic present on the road network. IEMA guidelines note that additional delays are only likely to be significant if the traffic on the network is already at, or close to, capacity. Key areas where delays may occur include:

- At the site entrance due to turning of vehicles.
- On the highway passing the site.
- At key intersections along the highway.
- At junctions where the ability to find gaps in the traffic may be reduced, thereby lengthening delays.

Pedestrian amenity

This is broadly defined as the relative pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width / separation from traffic. IEMA guidelines state that this may be significant where traffic is either halved or doubled.

Severance

IEMA guidelines state that severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. The term is used to describe a complex series of factors that separate people from places and other people. Severance can also result from difficulty in crossing a heavily trafficked road. The guidance indicates that severance effects are considered ‘slight’ in cases that include:

- Pedestrian at-grade crossings on new roads carrying below 8,000 vehicles per day (AADT) (DoT, June 1993); or
- Changes of traffic flow of less than 30% (IEMA, March 1993).

Pedestrian delay

Changes in the volume and composition or speed of traffic on the road network may affect the ability of people to cross roads. In general, increasing traffic volumes will lead to an increase in pedestrian delay. Thresholds are not recommended for use to identify significance of potential effects due to the range of local factors and conditions which can affect delay.

7. Potential Environmental and Social Impacts

7.1 Construction Impacts

The assessment has been undertaken in accordance with the criteria set out in Section 4 (Assessment Methodology). The impacts, including conclusions on their potential significance, are described below. Mitigation is described in Chapter 8. Residual impacts are described in Chapter 9.

7.1.1 Air Quality

Air pollution may also arise as a result of dust emanating from vehicle movements and other construction activity. However, this will be a temporary effect that can be mitigated by restricting vehicles to sealed access tracks and the use of dust suppression measures.

The Project impacts may include:

- Dust and engine emissions created by construction activities (i.e. earthworks, demolition and operation of machinery) could influence the local ambient air quality.
- The release of exhaust emissions to the atmosphere could have an effect on the local ambient air quality.

The rural nature of the site, the expansiveness of the landscape and the limited amount of traffic present mean that vehicle emissions are not predicted to be significant. As a result, the air quality assessment considers only dust emissions.

There is a fishpond located outside the southwestern boundary of the site that is used as a source of livelihood. It was noted during AECOM's site visit in December 2021 that one pond was dry and the second had low water but no fish.

<table>
<tr><th colspan="6">Impact Assessment: Impacts on air quality during construction</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="2">Positive</td><td colspan="3">Negative</td></tr>
<tr><td colspan="5">Impact is negative because construction activities may result in increased air pollution. This may result is nuisance or in more extreme cases could exacerbate respiratory illness.
High levels of dust may change the chemistry of water resources or increase the sediment loading. In terms of impact, Staub (2000)[124] considered that in high sediment-concentration flow, fish have to increase their amount of movement, respiratory rate and oxygen demand, and may be prone to gill blockage; when the dissolved oxygen content is lower than 2mg/l or the sediment concentration is over 30kg/m^3</td></tr>
<tr><td rowspan="2">Impact Type</td><td>Direct</td><td>Indirect</td><td colspan="2">Reversible</td><td>Irreversible</td></tr>
<tr><td colspan="5">The impact is direct as construction activities would directly increaseair pollution.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Medium-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impact is temporary as impacts would occur during the construction phase only.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td colspan="3">National</td></tr>
<tr><td colspan="5">The impact is expected to occur within the site and adjacent areas.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td colspan="2">Medium</td><td>High</td></tr>
<tr><td colspan="5">Residential receptors are located approximately 100 m of the southern boundary of the Project site therefore receptor sensitivity is determined to be Medium.
There is a fishpond located outside the southwestern boundary of the site that is used as a source of livelihood. It was noted during AECOM's site visit in December 2021 that one pond was dry and the second had low water but no fish. AECOM understand that carp are farmed. However, the high levels of sedimentation needed to cause distress or mortality is 30kg/m^3 which is not assessed to be likely as a result of dust from construction. In addition, the fish ponds are fed by piped irrigation water which would continue to recharge with clean water. As a result, impacts on water quality is not considered further.</td></tr>
<tr><td></td><td>No change</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
</table>

[124] Staub, E. (2000). Effects of Sediment Flushing on Fish and Invertebrates in Swiss Alpine Rivers. International Workshop and Symposium on Reservoir Sediment Management, Toyama City, Japan, 185-193.

Impact Assessment: Impacts on air quality during construction					
Impact Magnitude	Magnitude of change is anticipated to be medium as there is likely to be an increase in levels of dust to air associated with construction of the Project at nearby residential receptors.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, on the basis that two residential receptors are approximately 100m from the site boundary and construction vehicles would pass closer to and from site. The implementation of Good International Industry Practise pollution prevention measures is considered very likely to reduce the impacts. However, additional mitigation measures are required.				

7.7.1 Archaeology and Cultural Heritage

The Project is not deemed to have a direct adverse impact on any international or nationally recognised cultural heritage.

Solar Site

No significant cultural heritage receptors are currently known from within the Solar Array Site. It is not located in an area of known archaeological potential – although it has a south-facing aspect, there are no presently identified remains from this terrace. Known remains in the surrounding region focus on river valleys, prominent strategic positions, terraces, caves and rock shelters. The area has been subject to previous ploughing, which may have levelled any earthworks and resulted in minor damage to any underlying archaeological deposits.

In the Solar Array site, there is the potential for the discovery of unrecorded buried archaeological remains and surface findspots during the construction phase, as the Project will involve ground clearance activities such as levelling, grading and excavation works. Permanent components include the solar PV system, a new substation, and access roads; temporary construction stage elements include construction and laydown areas, worker accommodation, spoil storage and disposal, and temporary access tracks. These works and related activities such as fence installation and vehicle tracking, compaction and rutting have the potential to directly impact on any unrecorded buried archaeological remains which may be present within the Solar Array site and may be of archaeological importance.

The Solar Array will impact on the setting of the small cemetery and mosque that will be surrounded by it [**ACH119**]. The scale and proximity of the development is such that it is not considered that effective mitigation is feasible. For this reason, the impact of the Solar Array site on the setting of heritage assets is assessed as Medium.

Transmission Line

Irrigation works in the vicinity of the Transmission Line may have resulted in widespread levelling and burial beneath dredged deposits. There is therefore potential for localised preservation beneath alluvial and colluvial deposits and made ground, and for finds scatters and spreads being brought to the surface by ploughing, irrigation and construction activities. The excavation of footings for the transmission towers and compaction and rutting of the ground surface by machinery used to string the overhead line may result in localised impacts on any earthworks or buried archaeological remains, surface and near-surface findspots, including finds scatters in the vicinity of prehistoric and protohistoric settlement areas.

Construction of the Transmission Line will impact upon the setting of Takiya cemetery and mosque [**ACH099**] and Hodzhanata cemetery and shrine [**ACH100**]. The Transmission Line route will be visible from a number of heritage assets. In this low-lying area, tall Transmission Line towers will be readily visible. However, it is not considered that construction activity associated with installation of the Transmission Line – tower assembly, tower erection and OHTL stringing works within the easement – would affect the legibility of the historic landscape or detract from the significance of the large *tepa* sites rising up out of the surrounding lowlands. It is not anticipated that construction-stage views, noise, dust and vibration will affect the ability to appreciate the significance of the historic landscape or individual monuments. For this reason, the impact of the Transmission Line on the setting of heritage assets is assessed as Low.

Impact Assessment: Impacts on archaeology and cultural heritage during construction					
Impact Nature	Positive	Negative			
	Impact is negative because construction activities may result in physical disturbance to cultural heritage features.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is generally direct as archaeology features could be disturbed by construction activities.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent, as impacts occur there would be an irreversible change to the baseline within the Project site.				
Impact Extent	Local	Regional	National		
	Any potential impact is expected to occur within the Solar Array site or Transmission Line route, transmission towers and ancillary construction sites. There are no known designated heritage assets within the Project footprint, but there are ruins, mounds and *tepa* settlement mounds in the vicinity of the Transmission Line and any associated artefact scatters and surrounding settlement may be impacted by construction. Any impact would be on previously undiscovered remains.				
Receptor Value / Sensitivity	Low	Medium	High		
	There are known heritage assets within or in the immediate vicinity of the Transmission Line route that are comparable to, or associated with, designated heritage assets: these are assessed as medium sensitivity. Islamic cemetery **ACH119**, located adjacent to the Solar Array, is a community asset of high sensitivity.				
Impact Magnitude	No change	Low	Medium	High	
	The magnitude of change on archaeology is anticipated to be low as there is localised potential to physically disturb any surviving remains. Setting impacts related to cemetery **ACH119** adjacent to the Solar Array site, are not capable of effective mitigation, resulting in a medium score for impact magnitude.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as medium prior to additional mitigation measures being implemented.				

7.1.2 Biodiversity

7.1.2.1 Avifauna

Summary (Baseline)

The Solar PV site is not deemed to be an important habitat for avian species. The proposed operational Overhead Line is not located on a major bottle neck or geographical feature that would concentrate migrating species. The Karasu river valley has a north-south orientation and therefore there is potential that this geographical feature functions as a migratory corridor linking the Amudarya River (including the Amudarya Floodlands IBA), to the south, with the Middle reaches of the Sherabad River IBA, to the north; the latter supports migratory flyway ornithological features of species/species groups which are particularly vulnerable to collision with powerlines. However, the narrow and shallow river valley, which dissects an extensive flat plain, is not a geographical feature which is likely to coerce northward or southward migrating raptors, storks and cranes into concentrated migration along the Karasu Valley; migration is likely to be on a broad front across the plain between the Amudarya River (flows along the Uzbekistan-Afghanistan border) and the Kelif-Sherabad Ridge upland area to the north. The results of the Sunscape 2020 and the AECOM 2022 field surveys (undertaken during the early and mid- spring passage periods, respectively) show that a number of IUCN threatened/Uzbekistan Red Book migratory species, which are particularly vulnerable to collision with powerlines, have been recorded as features of the AoI for the Overhead Line, however their respective populations are low and therefore insufficient to trigger critical habitat for Criterion 1 (Tiers 1 & 2): Egyptian vulture (IUCN [EN] & URDB [VU]), eastern imperial eagle (IUCN [VU] & URDB [VU]), little bustard (URDB [VU]); these are also PBF species (refer to Appendix D).

Survey work has confirmed that the AoI for the Overhead Line is not important for breeding or resident species, including the following IUCN threatened/Uzbekistan Red Book species of conservation concern which are particularly vulnerable to collision with powerlines: eastern imperial eagle (IUCN [VU]

& URDB [VU]), Eurasian griffon vulture (URDB [VU] and cinerous vulture (URDB [VU]). The AECOM 2022 surveys confirmed the absence of Asian houbara (IUCN [VU]). These were recorded in low numbers and there is no reasonable likelihood that these populations are internationally or nationally significant.

Potential Impacts

Potential impacts to birds from the construction activities are:

- Displacement of birds by the presence of new infrastructure (pylons, overhead wires), which may occur as both the deterrence of bird activity among and close to the pylons and also as a barrier effect to movement of birds across the Project area in the vicinity of new overhead wires;
- Permanent habitat loss, fragmentation and / or degradation resulting from the construction of new infrastructure; and
- Disturbance of birds from people and traffic during operational maintenance.

Impact Assessment

<table>
<tr><th colspan="5">Impact Assessment: Impacts on ornithology during construction (PBF species) – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="2">Positive</td><td colspan="2">Negative</td></tr>
<tr><td colspan="4">Impact is negative because construction activities may result in habitat loss and disturbance.</td></tr>
<tr><td rowspan="2">Impact Type</td><td>Direct</td><td>Indirect</td><td>Reversible</td><td>Irreversible</td></tr>
<tr><td colspan="4">The impact is generally direct and irreversible as potential foraging habitat may be lost through construction activities (e.g. ground clearance to accommodate infrastructure). There will be no direct destruction or damage to active nests due to the unsuitability of the habitat within the project footprint for those PDF species which have breeding ranges that have the potential to overlap the project, ie. saker falcon, golden eagle , Egyptian vulture, Eurasian griffon vulture and bearded vulture.

Site clearance and construction of solar panel infrastructure, pylons, powerlines, access roads and other infrastructure may create barrier effects for PBF birds migrating (overflying) the Project site, particularly the following species autumn and spring passage: steppe eagle, Egyptian vulture and eastern imperial eagle. It is possible that individuals will be deterred from using preferred migration routes during periods where there is more intense activity and more people are present in the landscape.
However, reversible barrier displacement effects for the Overhead Line will be limited to localised areas and focussed on pylon locations</td></tr>
<tr><td rowspan="2">Impact Duration</td><td colspan="4">Temporary | Short-term | Medium-term | Long-term | Permanent</td></tr>
<tr><td colspan="4">Displacement impacts (relating to disturbance and barrier effects) are temporary and short-term as construction works are expected to continue for a period of approximately 18 months.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td>National</td><td>International</td></tr>
<tr><td colspan="4">The impact is expected to occur within or immediately adjacent to the Project site.

Given the distance between the Project site and the closest IBA's (at their closest points), and the lack of habitat connectivity or potential pathways between these IBA's and the Project site, there is no reasonable likelihood of significant direct or indirect impacts.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="4">The PBF bird species which have been recorded as present or assessed as having a reasonable likelihood of occurrence are not critical habitat qualifying species and are therefore not of very high or high sensitivity according to the criteria detailed above. In terms of the PBF species which have been recorded, these have been recorded in numbers which are not significant and are assigned a Medium sensitivity value.</td></tr>
</table>

Impact Assessment: Impacts on ornithology during construction (PBF species) – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.					
	Very small numbers of IBA qualifying species were recorded within the Project site, however the numbers recorded are unlikely to be significant (defined as >1%) of the IBA population. The project does not support breeding populations for PBF birds and the habitat is not suitable for these species. Sociable lapwing (IUCB [CR]) has the potential to occasionally overfly the project site on spring and autumn passage. However, there is no reasonable likelihood that the project is located on a significant migratory corridor for this species and the sensitivity is assessed a Low.				
Impact Magnitude	Negligible	Low	Medium	High	
	For the Solar PV the magnitude of the effect is predicted to be Negligible for breeding PBF birds given their likely absence from the Solar PV Project site. The magnitude of the effect is predicted to be Low for non-breeding birds PBF raptor species overflying on spring and autumn migration, in terms of disturbance displacement (barrier to movement) during the construction phase. The magnitude of the effect for the Overhead Line is expected to be Negligible in terms of breeding by PBF birds considering the likely absence of nest sites at the areas to be cleared within the respective very localised pylon footprints. The magnitude of the barrier effect is predicted to be Low for non-breeding birds PBF raptor species overflying the AOI on spring and autumn migration, in terms of disturbance displacement (barrier to movement) during the construction phase.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as Negligible and Low for PBF bird species and not significant for the Solar PV and the Overhead Line, respectively. There is a requirement for the project to achieve No Net Loss of species defined as PBFs.				

Impact Assessment: Impacts on ornithology (non PBF species) during construction					
Impact Nature	Positive	Negative			
	Impact is negative because construction activities may result in habitat loss and disturbance.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is generally direct as habitat will be lost through construction activities (e.g. ground clearance to accommodate infrastructure associated with the Solar PV and transmission line [pylons]), this could include direct destruction or damage to bird nests (e.g. crested lark and wheatears). In addition, disturbance caused by construction activities may directly displace birds from breeding sites and/or foraging areas due to noise and visual disturbance.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	Displacement impacts are temporary and short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	Local	Regional	National	International	
	The impact is expected to be restricted to the Project site. Given the distance between the Project site and the IBAs, and the lack of habitat connectivity or potential pathways between these IBA's and the Project site, there is no reasonable likelihood of significant direct or indirect impacts.				
	Negligible	Low	Medium	High	

<table>
<tr><th colspan="6">Impact Assessment: Impacts on ornithology (non PBF species) during construction</th></tr>
<tr><td>Receptor Value / Sensitivity</td><td colspan="5">The Solar PV footprint supports a limited assemblage of breeding species which are not of international or national conservation concern.

This ornithological receptor has been assessed as Low value.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>No change</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The magnitude of the effect for the Solar PV site is predicted to be Medium given the area of the site that will require to be cleared and / or disturbed and that there is potential for loss/damage to eggs and nests of common ground nesting birds if site clearance occurs during the breeding bird season. The magnitude of the effect for the Overhead Line is expected to be Low as the areas to be cleared within the respective pylon footprints will be very localised. Therefore, the magnitude of the effect for the Project site is assessed as Medium (overall).</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">As a result, the impact is assessed as Low and not significant, however it is recommended standard mitigation measures are implemented to ensure impacts remain minimal.</td></tr>
</table>

7.1.2.2 Terrestrial Ecology

Baseline (Summary)

Critical habitat requirements are applicable for the Project site with respect to the Tajikistan Toadhead Agama (*Phrynocephalus sogdianus*) (refer to Appendix D: Critical Habitat Assessment [Turnstone Ecology, 2022])..Tajikistan toadhead agama is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands. None were recorded in or around the Solar PV Site and habitats in this area are considered unsuitable. However, up to 30 individuals were found in sand dune/semi-fixed sand habitat in the vicinity of the Overhead Line route at the Khaudag Ridge during reptile surveys completed in April 2022. Habitats within the Overhead Line route in the Khaudag Ridge area are considered suitable for this species and are contiguous to the area where individuals were recorded in 2022.

A further three PBF reptile species were confirmed as present within the Project site as a result of the ecological field surveys: Central Asian tortoise (IUCN VU, URDB VU), black-oscellated racerunner (URDB VU) and tatar sand boa (URDB NT). An additional six reptile species are assigned PBF status when assessed against guidelines as set out in EBRD PR6 GN (refer to Appendix D): Boettiger Caspian toadhead agama, Transcaspian desert monitor, Indian gamma snake, Afghan awl-headed snake, northern (barred) wolf snake and southern even-fingered gecko. The latter species is listed by the IUCN as Critically Endangered (CR).

A single mammal of national conservation concern is confirmed present within a localised part of the Overhead Line (the Karasu River crossing): Brandt's hedgehog (URDB). Marbled polecat (IUCN VU & URDB) may also occur within the Project site, however there were no records of this species during the field surveys. Nevertheless, marbled polecat has been included as a PBF when assessed against guidelines as set out in EBRD PR6 GN.

A single individual of a flowering plant that is listed within the Red Data of Uzbekistan is present within the Solar PV site: *Chesneya tribuloides*.

Based on the initial site design, a total of 7.34 ha land would be cleared or just under 1.2% of the overall site area. This area currently does not include land required for internal access roads. It is estimated that there would be an additional 1% coverage by roads taking the area of habitat lost to 2.2%. There would be 228.6ha shaded by panels or 37% of the site area.

<table>
<tr><th colspan="21">Impact Assessment: Impacts on a CH species: Tajikistan Toadhead Agama (Phrynocephalus sogdianus) – Critical Habitat has been triggered under IFC Criterion 1 and EBRD Criterion ii - during Construction</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="10">Positive</td><td colspan="10">Negative</td></tr>
<tr><td colspan="20">The types of potential effects on this faunal receptor from maintenance operations are broadly similar to those described for the aforementioned assessment of construction related disturbance, direct mortality/injury (vehicle collisions), population changes (hunting/take) and hydrological alteration of habitat. However, effect magnitudes would be expected to be lower during the operational phase due to the reduced level of human activity within the project site.</td></tr>
<tr><td rowspan="2">Impact Type</td><td colspan="10">Direct</td><td colspan="10">Indirect</td></tr>
<tr><td colspan="20">The impacts listed above are all considered to be direct effects of Project operation.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td colspan="4">Temporary</td><td colspan="4">Short-term</td><td colspan="4">Medium-term</td><td colspan="4">Long-term</td><td colspan="4">Permanent</td></tr>
<tr><td colspan="20">The impacts will be experienced during the 18 month construction schedule and are therefore short-term.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td colspan="5">Local</td><td colspan="5">Regional</td><td colspan="5">National</td><td colspan="5">International</td></tr>
<tr><td colspan="20">The impacts are expected to be restricted to the Project site where the Overhead Line crossed the Khaudag Ridge.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td colspan="5">Negligible</td><td colspan="5">Low</td><td colspan="5">Medium</td><td colspan="5">High</td></tr>
<tr><td colspan="20">As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are applicable for Tajikistan toadhead agama. This species is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands and up to 30 individuals were found in sand dune/semi-fixed sand habitat in the vicinity of the Overhead Line route at the Khaudag Ridge during reptile surveys completed in April 2022. Habitats within the Overhead Line route in the Khaudag Ridge area are considered suitable for this species and are contiguous to the area where individuals were recorded in 2022. The EAAA used for the CHA has therefore been determined to include areas of suitable habitat that are likely contiguous with the Overhead Line route which are not separated or modified by agriculture or urbanisation; it is calculated to be 250km^2 (refer to Appendix D). This species is therefore assigned a ‘High’ sensitivity value for the Overhead Line element of the project.

None were recorded in or around the Solar PV Site and habitats in this area are considered unsuitable; the Solar PV does not support sand dune habitat required by this species. Tajikistan toadhead agama is therefore assigned a ‘Negligible’ sensitivity value for the Solar PV element of the project.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td colspan="5">Negligible</td><td colspan="5">Low</td><td colspan="5">Medium</td><td colspan="5">High</td></tr>
<tr><td colspan="20">This species is likely absent from the Solar PV site so the magnitude of impact for this element of the project is Negligible.

The magnitude of the impact for the <u>Overhead Line</u> is expected to be <u>Low</u> for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td colspan="4">None</td><td colspan="4">Negligible</td><td colspan="4">Low</td><td colspan="4">Medium</td><td colspan="4">High</td></tr>
<tr><td colspan="20">The impact is assessed as Medium and significant for the Overhead Line crossing of the Khaudag Ridge and None for the Solar PV element of the project.

There is a requirement for the project to achieve Net Gains for this Critical Habitat qualifying species. The mitigation measures required to achieve net gain will be detailed within a Biodiversity Action Plan (BAP) for the species.</td></tr>
</table>

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Smooth Even-fingered Gecko (Alsophylax laevis), a Critically Endangered Species - during Operation</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="2">Positive</td><td colspan="3">Negative</td></tr>
<tr><td colspan="5">The types of potential effects on this faunal receptor from maintenance operations are broadly similar to those described for the aforementioned assessment of construction related disturbance, direct mortality/injury (vehicle collisions), population changes (hunting/take) and hydrological alteration of habitat. However, effect magnitudes would be expected to be lower during the operational phase due to the reduced level of human activity within the project site.</td></tr>
<tr><td rowspan="2">Impact Type</td><td colspan="2">Direct</td><td colspan="3">Indirect</td></tr>
<tr><td colspan="5">The impacts listed above are all considered to be direct effects of Project construction.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Medium-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impacts will be experienced during the 18 month construction schedule and are therefore short-term.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td>National</td><td colspan="2">International</td></tr>
<tr><td colspan="5">The impacts are expected to be restricted to the Project site.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are not applicable for southern even-fingered gecko, however this species is listed as Critically Endangered by the IUCN. This species was not recorded during any of the daytime or nocturnal reptile surveys and is likely absent from the Project area. Nazarov (2020) suggested that the most suitable habitat for this species, within the AOI of the Project site, is the riparian habitat at the Karasu river valley crossing. The OHTL will cross the river as a free span therefore no works will take place within the river valley.

This species is assigned a ‘High’ sensitivity value given its conservation status.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">A high proportion of the habitat will be shaded by the solar panels and therefore the magnitude of the effect is predicted to be precautionarily assessed as Medium (overall) for this species assuming that it is present within the Solar PV site.

Based on the initial site design, a total of 7.34 ha land would be cleared or just under 1.2% of the overall site area. This area currently does not include land required for internal access roads. It is estimated that there would be an additional 1% coverage by roads taking the area of habitat lost to 2.2%. There would be 228.6ha shaded by panels or 37% of the site area.

The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site.

The magnitude of the impact for the Overhead Line is expected to be Low for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no impacts are expected for this sensitive habitat area for smooth even-fingered gecko. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to construction activities is assessed as Negligible .</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">On a precautionary basis, the impact is assessed as Low and not significant for the Solar PV and OHTL.</td></tr>
</table>

<table>
<tr><th colspan="2">Impact Assessment: Impacts on Smooth Even-fingered Gecko (Alsophylax laevis), a Critically Endangered Species - during Operation</th></tr>
<tr><td></td><td>Southern even-fingered meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. There is therefore the requirement for the project to achieve No Net Loss of species.</td></tr>
</table>

<table>
<tr><th colspan="6">Impact Assessment: Impacts on other PBF species: Central Asian tortoise, Boettiger Caspian toadhead agama, black ocellated racerunner, Transcaspian desert monitor, Indian gamma snake, Afghan awl-headed snake, northern (barred) wolf snake, tartar sand boa and marbled polecat</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="2">Positive</td><td colspan="3">Negative</td></tr>
<tr><td colspan="5">The types of potential effects on PBF faunal receptors) are related to disturbance, direct mortality/injury (vehicle</td></tr>
<tr><td rowspan="2">Impact Type</td><td colspan="2">Direct</td><td colspan="3">Indirect</td></tr>
<tr><td colspan="5">The impacts listed above are all considered to be direct effects of Project construction.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Medium-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impacts will last 18 months through the construction program and are therefore considered short term.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td colspan="2">National</td><td>International</td></tr>
<tr><td colspan="5">The impacts are expected to be restricted to the Project site.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td><td>Very High</td></tr>
<tr><td colspan="5">These PBF reptile species are assigned a Medium value due to their presence or potential presence within the Project AoI and their respective inclusion as species listed on the Red Data Book of Uzbekistan. Marbled polecat is assigned Vulnerable status by IUCN. All PBF faunal species present or potentially present within the Project AoI are assigned Medium value for both elements of the Project (ie. Solar PV and Overhead Line).</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td colspan="2">Medium</td><td>High</td></tr>
<tr><td colspan="5">A high proportion of the habitat will be disturbed for the roads, hardstandings, roads and solar panel bases and therefore the magnitude of the effect is predicted to be precautionarily assessed as Medium (overall) for terrestrial ecology. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality of fauna and Chesneya tribuloides due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site.

The magnitude of the impact for the <u>Overhead Line</u> is expected to be <u>Low</u> for terrestrial ecology, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small, including the Khaudag sensitive reptile area. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no impacts are expected for this sensitive reptile habitat.</td></tr>
<tr><td></td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
</table>

Impact Significance	The impact is assessed as Medium for the Solar PV and therefore significant. The impact is assessed as Low for the operational Overhead Line and not significant. A suite of both standard mitigation measures and species-specific mitigation measures will be implemented to ensure impacts are not significant.

Impact Assessment: Impacts on other terrestrial ecology (non PBF species) during construction					
Impact Nature	Positive	**Negative**			
	Impact is negative because construction activities may result in habitat loss and disturbance.				
Impact Type	**Direct**	Indirect	Reversible	**Irreversible**	
	The impact is generally direct as habitat will be lost through construction activities (e.g. ground clearance to accommodate infrastructure associated with the Solar PV and transmission line [pylons]), this could include direct destruction or damage of fauna and flora. In addition, disturbance caused by construction activities may directly displace/disturb fauna. Construction vehicles and excavated areas can pose a risk of death or injury to fauna.				
Impact Duration	**Temporary**	**Short-term**	Medium-term	Long-term	**Permanent**
	Initial topsoil stripping will take place during the first 1-2 months of construction within the parts of the Project Site required for permanent compounds and hard standing. The impact is permanent as there would be an irreversible change to the baseline within the Project site for the lifetime of the Project. Displacement impacts are temporary and short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	**Local**	Regional	National		
	The impact is expected to occur within the Project site. Given the distance between the Project site and the IBAs (at their closest points), and the lack of habitat connectivity or potential pathways between these IBAs and the Project site, there is no reasonable likelihood of significant direct or indirect impacts on faunal receptors associated with these internationally recognised sites.				
Receptor Value / Sensitivity	**Low**	Medium	High		
	All non-PBF faunal species present or potentially present within the AoI are assessed as not exceeding medium value and are assigned Negligible-Medium value. The Uzbekistan Red Listed flowering plant Chesneya tribuloides is also assigned a Medium value for the operational Solar PV site, as it is assumed that the plant, which grows on the steep-sloped periphery of the site, will be undisturbed retained during the construction phase and therefore will be retained in situ within the operational solar farm design (ie. it is assumed that the steep slopes of the western escarpment are unsuitable for solar panels or other solar farm infrastructure/access roads and will not be impacted by earthworks). No habitat types or ecosystems were present or identified as being potentially present for the Solar PV/Overhead Line that would be considered as priority habitats as such Criterion 1: Threatened Habitat (PBF guidelines as set out in EBRD PR6 GN) [refer to Appendix D: Critical Habitat Assessment Report [Turnston Ecology, 2022)]. However, fragmented areas of Natural Habitat (degraded) occurs within the Solar PV and the Overhead Line crosses the Shuratakum Gorge, Karasu River and Khaudag Ridge, which also support Natural Habitat (degraded). Therefore a Medium sensitivity is assigned for the Soalr PV and Overhead Line. Therefore, the overall value for sensitivity of the terrestrial ecological receptors is Medium (overall) for both elements of the Project (ie. Solar PV and Overhead Line).				

Impact Assessment: Impacts on other terrestrial ecology (non PBF species) during construction					
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be Medium given the area of the Project site that will require to be cleared and / or disturbed. The magnitude of the effect for the Solar PV site is predicted to be Medium given the area of the site that will require to be cleared and / or disturbed and that there is potential for loss/mortality of reptiles and small mammals. The magnitude of the effect for the Overhead Line is expected to be Low, as the areas to be cleared within the respective pylon footprints will be very localised. Therefore, the magnitude of the effect for the Project site is assessed as Medium (overall).				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as Low and not significant. A suite of both standard mitigation measures[125] and species-specific mitigation measures will be implemented to ensure impacts are reduced to Low significance or below.				

7.1.3 Geology and Soils

7.1.3.1 General

The main impact on soils during construction will be the potential for soil contamination from spills and leaks and increase in vulnerability to erosion. Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable when wet (i.e. during snowmelt or heavy rain), when vehicle traffic is likely to cause the greatest damage.

Where roads are un-surfaced, rutting and gully erosion eventually make the roads impassable so that vehicles drive off the track and the area affected by erosion continually widens.

The following types of construction activity could lead to potential soil erosion:

- Vehicle traffic along dirt tracks used during construction of on- and off-site roads, power lines, control centre and solar panels will cause soil compaction.
- Off-road vehicle traffic will damage vegetation and cause soil compaction.
- Any vegetation and some soil will be removed for the control centre, solar panel foundations, transmission towers, and both on- and off-site roads.
- The use of heavy equipment will cause soil compaction if used outside designated roads.
- Soil erosion from increased water run-off, can cause sediment release to nearby water bodies.
- Ability of soils to support foundations.

Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable during the rainy seasons, when vehicle traffic is likely to cause the greatest damage.

Where roads are un-surfaced, rutting and gully erosion eventually makes the roads impassable so that vehicles drive off the track and the area affected by erosion continually widens.

7.1.3.2 Ground conditions

Electrical equipment (transformers, inverters, electrical switchgear) heavy duty equipment and ancillary buildings (office building, meteorological towers) are usually earthed by means of surface mats.

[125] For example: NetRegs (2020). Guidance for Pollution Prevention (GPP). Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

The existence of weak soils up to a depth of around 15 meters, suggests the likely existence of partial collapsible areas that could develop until reaching the surface. Furthermore, a layer of gypsum was identified approximately 1-2m below ground level.

It is considered that collapse behaviour can take place within this superficial unit in different areas of the PV parcel.

Consequently, it is not advisable to rely on the strength of this soil to support any foundation but to undertake ground improvement treatment.

Impact Assessment: Impacts on soil quality during construction					
Impact Nature	Positive	**Negative**			
	Reduction in local soil quality as a result of construction activities causing erosion related to increased water run-off, soil compaction and loss of limited vegetation. Soil quality can also be negatively affected by spillage of oils during maintenance of machinery, improper storage of hazardous materials, spillage during transfers of fuel and improper disposal of waste.				
Impact Type	**Direct**	Indirect	**Reversible**	Irreversible	
	The impact is generally direct as soils / geology resources will be affected through construction activities.				
Impact Duration	**Temporary**	**Short-term**	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	**Local**	Regional	National		
	The impact is expected to occur within the site and sedimentation/oil or chemical release would be at a local level only.				
Receptor Value / Sensitivity	Negligible	**Low**	Medium	High	
	The sensitivity of soils in the Project area is assessed as Low. Whilst it is recognised that soils will be most vulnerable during high rainfall and snowmelt, the limited geographical extent does not require higher sensitivity. The gypsum layer on the project site may affect the stability of the piled foundations,				
Impact Magnitude	No change	Negligible	**Low**	Medium	High
	The magnitude of the effect is predicted to be Low, given that there is potential for construction activities to notably change the resource, particularly during rainy season. Impacts of fuel spills are deemed to be highly localised.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the significance of the impact is assessed as Low. The extent of reduced soil quality due to construction activities is considered local, and the duration assessed as being temporary and short-term.				

7.1.4 Hydrology and Hydrogeology

7.1.4.1 Surface Water

There are no permanent waterbodies within the Solar PV Site. Permanent watercourses nearest to the Solar PV Site boundary are the irrigation canals and fish pond approximately 100m south of the site, and the Karasu River, crossed by the transmission line. It is proposed that the river be crossed by a free span and that no construction works will take place within the river or gorge.

Surface water may be subject to reduction in quality should proper mitigation not be implemented. The waterbodies adjacent to the site are currently used as a source of irrigation water.

During construction, earthworks, road construction and use of heavy vehicles could alter surface drainage patterns. The removal of vegetation and compaction of soils will reduce infiltration and surface run-off will increase. The risk is greatest during severe precipitation events, which are most likely to occur in spring. The increased volume of water flowing into drainage channels is likely to cause additional soil erosion. Surface run-off will also contain higher concentrations of suspended sediments during construction than would otherwise be the case. Other potential sources of pollution during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater.

Impact Assessment: Impacts on surface water during construction					
Impact Nature	Positive	**Negative**			
	Impact is negative because construction activities may generate pollutants that reduce the quality of surface water used for irrigation.				
Impact Type	**Direct**	Indirect	**Reversible**	Irreversible	
	The impact is generally direct and potential sources of pollution to surface water during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater which may subsequently run off to nearby surface water bodies. Surface water run-off may have a higher sediment load. The localised nature of spills likely to be experienced can be addressed through standard construction practises including appropriate drainage and containment. Pollution risks will continue during the construction phase.				
Impact Duration	**Temporary**	**Short-term**	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	**Local**	Regional	National		
	The impact is expected to occur within the site and run-off from potential spills or sediment would be at a local level only. Chemicals and fuels are not stored in sufficient quantities to result in a spill of regional importance.				
Receptor Value / Sensitivity	Negligible	Low	**Medium**	High	
	The sensitivity of surface water is assessed as Medium, recognising that the canals are a source of irrigation water.				
Impact Magnitude	No change	Negligible	**Low**	Medium	High
	The magnitude of the effect is predicted to be low given the limited area of the Project site in relation to the overall catchment area.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the significance of the impact is assessed as Low. The extent of reduced surface water quality due to construction activities is considered local, and the duration assessed as being temporary and short-term.				

7.1.4.2 Groundwater

The amount of water required during construction is estimated at 35,834 m^3. The source of water required for construction has not yet been determined.

Local communities within the vicinity of the Project use tankered water for drinking water.

Potential sources of pollution to groundwater during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater. During construction, sanitary waste will be collected in containers below portable toilets and transported to a registered waste disposal facility for disposal. Storage and handling procedures for oils and other chemicals will be required to minimize risk of pollution.

Potential impacts on groundwater include:

- Accident/ unplanned event: Groundwater could be contaminated through accidental fuel spills.
- Accident/ unplanned event: Depending on the method of waste disposal, impacts could be felt on surface or groundwater, flora and fauna and/ or local communities.

Impact Assessment: Impacts on groundwater during construction				
Impact Nature	Positive	**Negative**		
	Impact is negative because construction activities may generate pollutants that reduce the quality of groundwater used by local residents for domestic purposes.			
Impact Type	**Direct**	Indirect	**Reversible**	Irreversible
	The impact is generally direct and potential sources of pollution to groundwater during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste			

Impact Assessment: Impacts on groundwater during construction					
	and wastewater. The localised nature of spills likely to be experienced can be addressed through standard construction practises including appropriate drainage and containment. Pollution risks will continue during the construction phase.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and run-off from potential spills would be at a local level only. Chemicals and fuels are not stored in sufficient quantities to result in a spill of regional importance.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity of groundwater is assessed as low, recognising that groundwater is not abstracted by local residents.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be low, given that the depth of the groundwater is greater than 15 m and is likely to be considerably deeper.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Low adverse, on the basis that no farmers abstract groundwater for their use. The implementation of Good International Industry Practise pollution prevention measures is considered to make the contamination of groundwater very unlikely.				

7.1.5 Labour and Working Conditions

A sound worker-management relationship is a key requirement of the Project and a constructive worker-management relationship, by treating the workers fairly and providing them with safe and healthy working conditions, is required to ensure protection of the fundamental rights of workers.

The implementation of the actions necessary to meet these requirements will be managed through the Project's Environmental and Social Management System (ESMS).

The requirements apply to workers directly engaged by the client (direct workers), workers engaged through third parties to perform work related to the Project.

The aim of the Project's policies on labour and working conditions will be:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers especially vulnerable workers facing particular risks due to context-specific socioeconomic characteristics.
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labor laws.
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- To promote safe and healthy working conditions, and the health of workers.
- Zero tolerance for the use of forced labour and child labour.

Respecting the principles of freedom of association and collective bargaining.

Ensuring that accessible and effective means to raise and address workplace concerns are available to workers. During the construction phase, there may be occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. Key risks could include, *inter alia*, collision with vehicles and plant and exposure to a variety of hazards such as electric shock from exposed cables and thermal burn hazards and exposure to chemicals, hazardous or flammable materials.

Labour and working conditions, including occupational health and safety impacts, are considered to be of medium-term duration throughout the construction phase and are expected to be of potential high magnitude and high sensitivity as in extreme cases they could entail permanent impacts (e.g. death or permanent disability). As such, the impacts are considered to be of High impact and appropriate mitigation will be developed.

Impact Assessment: Occupational health and safety impacts during construction					
Impact Nature	Positive			Negative	
	There will be a range occupational health and safety risks throughout construction activities. This includes risk of injury, collision with plant and equipment, electrocution, thermal burn hazards, exposure to hazardous chemicals and working in extreme temperatures. Mismanagement of wastes (such as domestic solid waste, sewage and hazardous wastes) can also represent a health and safety risk to workers, such as disease, injury or death.				
Impact Type	Direct			Indirect	
	The risks are predominantly associated with direct impacts on the operational and maintenance workers due to the operation of the Project. Health and safety risks associated with waste mismanagement are considered indirect impacts. The Project's policies on labour and working conditions will further impact worker's income and wellbeing.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout the 18 month construction timeline and are therefore considered medium-term.				
Impact Extent	Local		Regional	National	
	The impacts will be limited to the project site and local area.				
Receptor Value / Sensitivity	Low	Medium		High	
	The receptors in this case are the operational workers. There are likely to be up to 1,000 workers at the peak and all are considered high value/sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Occupational health and safety impacts could result in disease, injury, or death to workers and so the magnitude is high.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact is assessed as High and significant. An independent Labour Assessment shall be undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors.				

7.1.6 Landscape and Visual

7.1.6.1 Impacts on Landscape Character and Visual Amenity

These include areas for temporary works, construction compounds, access road and on-site roads, areas for solar PV panels, substations and transformer stations, on-site and off-site transmission lines. New machinery and equipment will be introduced into the landscape, including heavy goods vehicles excavators, bulldozers, and other heavy equipment.

Impact Assessment: Impacts on Landscape Character					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities will result in additional features within the landscape. It is assumed that all Project related changes are negative in nature.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct and experienced within 5km of the Project site. The impact will continue for the duration of the Project and is therefore deemed to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The construction impact is short-term as construction works are expected to continue for a period of approximately 18 months. However impact will continue for the duration of the Project lifetime.				
Impact Extent	Local		Regional	National	

Impact Assessment: Impacts on Landscape Character	
	It is assessed that only a small proportion of the local landscape will be affected by the presence of construction works, topsoil stripping and bare ground.
Receptor Value / Sensitivity	Negligible / **Low** / Medium / High
	The sensitivity this landscape is assessed to be Low as it is not important in a local context. It is noted that the landscape is not designated at the local or national level and is influenced by man-made features.
Impact Magnitude	No change / Negligible / **Low** / Medium / High
	The magnitude of the effect is predicted to be low, as it is unlikely that construction works become the dominant feature in an area already impacted by human activity.
Impact Significance	None / Negligible / **Low** / Medium / High
	As a result, the significance of the impact is assessed as Low. Although impacts will be visible in places, the surrounding features such already include man-made features. Therefore, changes can be easily accommodated.

Impact Assessment: Impacts on Visual Amenity	
Impact Nature	Positive / **Negative**
	Impact is negative because construction activities will result in additional features within the landscape. It is assumed that all Project related changes are negative in nature.
Impact Type	**Direct** / Indirect / Reversible / **Irreversible**
	The impact is generally direct and experienced within 5km of the Project site. The impact will continue for the duration of the Project and is therefore deemed to be irreversible.
Impact Duration	**Temporary** / **Short-term** / Medium-term / **Long-term** / Permanent
	The construction impact is short-term as construction works are expected to continue for a period of approximately 18 months. However, impact will continue for the duration of the Project lifetime.
Impact Extent	**Local** / Regional / National
	It is assessed that the views experienced will include OHTLs and pylons, roads, substation and other man-made structures which reduce the quality of the views experienced.
Receptor Value / Sensitivity	Negligible / Low / Medium / **High**
	The sensitivity of the site is assessed to be High at VP1 cemetery and assessed as the worst case. The land at which the Project is located is flat, with very few trees, hedges or fences to obscure visibility, and as such visibility can extend for several kilometres. This applies to VP1 on the centre of the site. Sensitivity is lower at VP2 and VP3 to the north and south. Views from the south are often limited by the earthen bund that runs along the canal.
Impact Magnitude	No change / Low / **Medium** / High
	The magnitude of the effect is predicted to be low, because the visual impact of ground-level features is likely to be low, except at close range, due to the lack of vantage points overlooking the landscape.
Impact Significance	None / Negligible / Low / **Medium** / High
	As a result, the significance of the impact is assessed as Medium. Although impacts will be visible in places, particularly at the cemetery, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be generally accommodated. Mitigation will be proposed for the cemetery.

7.1.7 Noise

Noise pollution may result from the large workforce and construction activities, particularly the movement of trucks used to carry material to the site and removal of debris. Some heavy earth moving, and compacting machinery may be required for brief periods during construction but it is expected that much of the civil work will involve manual labour.

The main noise sources are:

- Truck and vehicle traffic along main transport/access routes will create noise and vibration that may increase ambient noise levels.
- Construction equipment and machinery could create noise and vibrations that may increase ambient noise levels.

The construction of the substation building / transformers and inverters are considered a worst-case construction noise scenario. Typically, associated construction activities within a 200 m distance from noise sensitive receptors have the potential to result in increased construction noise at receptor locations. It is expected that buffer of 100 m may not be maintained between site boundary fence and residential receptors on the southern boundary of the site. As a result there may be an increase in noise levels at these locations.

Impact Assessment: Impacts on noise and air pollution during construction					
Impact Nature	Positive	Negative			
	Impact is negative because construction activities may result in increased noise and air pollution.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is direct as construction activities would directly increase noise / air pollution.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and adjacent areas.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	Two residential receptors are located 100 m from the Project site therefore receptor sensitivity is determined to be medium. It is noted that a 4m earth bund created when the canals were constructed will provide a degree of noise attenuation, reducing the impact.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Medium as there is likely to be an increase in noise levels associated with construction of the Project at the closest residential receptors.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, on the basis that residential receptors are 100m from the site boundary. The implementation of Good International Industry Practise pollution prevention measures is considered very likely to reduce the impacts.				

7.1.8 Socio-economic Impacts

Based on the pathways described above, the following potential impacts were scoped in as the most relevant for the AoI and the socio-economic receptors.

- Community expectations of the Project. Increased local employment, capacity building and supply demand.
- Capacity strain contribution to local public services and facilities.
- Economic displacement.
- Loss of public access and reduced mobility through local paths.
- Reduced access to grazing and pastoral land.
- Increased presence of workers and interaction with local communities.
- Increased presence of security personnel.
- Increased levels of gender-based violence, sexual exploitation and harassment.

These will be described below. Increased road traffic will be detailed in the following section as a specific potential impact. Unplanned events are described below.

7.1.8.1 Community expectations of the Project

Local communities and the local economically active population may develop high expectations of the direct or indirect benefits of the Project, specifically regarding the number of work opportunities available. High expectations for jobs for the local communities will need to be continually managed from the early stages to avoid unrealistic Project expectations. It is proposed that a local hiring plan be developed to maximise employment opportunities for the local communities.

Impact Assessment: Community expectations of the Project				
Impact Nature	Positive		Negative	
	Impact is negative because unmanaged expectations may lead to heightened concerns / conflict with the local community that may ultimately negatively affect the Project's social license to operate.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is both direct and indirect as the Project will be announced and presented both as part of the regulatory process in the AoI and through the Project's own Stakeholder engagement efforts. It is also indirect because local stakeholders may disseminate expectations about the Project before it is formally disclosed. It is, however, reversible with robust stakeholder engagement.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as potential expectations will likely be highest in the lead up to the start of construction works but are not likely to continue beyond that. It is highly unlikely that expectations will be high during the operational phase.			
Impact Extent	Local	Regional	National	
	Given the high-level publicity surrounding the Project, the impact is expected to occur at a regional level in Surkhandarya.			
Impact Magnitude	Negligible	Low	Medium	High
	Sherabad is a predominantly rural area and thus its population may not have a clear understanding of the employment opportunities created by industrial development. However, the levels of unemployment in the region are high and therefore expectations may be higher than at the regional level. Therefore, the impact magnitude is medium at the local level (<10km) but reducing to Low at the regional level.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is low given that local communities and local economically active population are not depending on this Project specifically as their main source of income. However, this impact has the potential to increase unmanaged expectations among the unemployed and more vulnerable groups.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is Low. This is an adverse impact and the ongoing consultation and dissemination of Project information will be included in the Stakeholder Engagement Plan currently under development. This impact will be continuously managed throughout the construction phase (and ongoing operation phase).			

7.1.8.2 Economic displacement

There are three communities located near the Solar PV Area, but based on engagement findings they do not make use of the site. Herders occasionally use the Solar PV Area during the spring months, however all interviews with Mahallas and herders around the site suggested that the Project area is of inferior quality to the surrounding grazing land of which there is an abundant amount.

Most of the land required for the OHTL falls into 24 households whose leaseholds are used for the purposes of commercial farming.

Impact Assessment: Economic displacement		
Impact Nature	Positive	Negative
	Impact is negative because economic displacement would negatively affect a person's livelihood.	

Impact Assessment: Economic displacement				
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because the Project may occupy land previously used for farming/grazing.			
Impact Duration	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent as it would be in place for the full project lifetime.			
Impact Extent	Local	Regional	National	
	The impact may occur at a local level within the site boundary, including the OHTL, and immediate surroundings.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium as there is the potential to result in economic resettlement, particularly of herders.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is Low for leaseholders along the OHTL given they will have sufficient land remaining and for herders who make use of alternative higher quality land.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is Medium and specific mitigation in the form of cash compensation and livelihood restoration has been developed as part of the LRP.			

7.1.8.3 Loss of public access and reduced mobility through local paths

A boundary fence line shall be installed at the start of construction activities to prevent the entry of unauthorised personnel into working areas to maintain public health and safety. From the moment the fences are erected, local people from the AoI will lose access to footpaths inside the Project site. This shall result in longer time periods being required to move between locations when the footpaths are generally used. Of note, this impact does not relate to potential economic impacts (described above) or legal land lease aspects, but to the loss of informal mobility access in local paths.

Impact Assessment: Impacts from a loss of public access to footpaths inside the project area				
Impact Nature	Positive	Negative		
	Impact is negative as there will be a loss of access by footpaths into the Project area.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because local people shall no longer be able to access the roads/footpaths to travel. There are existing local paths marked within the site that may be occasionally used as a crossing area. Users will no longer be travelling inside the Project area as access to this land shall be lost. This impact is Irreversible as community access will be blocked for the lifetime of the project.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is considered to be long-term as community members and their herds will not have access across the area during operation. Full access may be reinstated after Project decommissioning. From AECOM's discussion with the regional agricultural department, the Makhallas , the cadaster who knows the site well and the informal farmer on the site, the herders tend to use the area of land outside of the site to the north and only use the site itself on occasion if there is enough vegetation in spring. All people interviewed said the land is of such poor quality due to lack of irrigation that herders don't use it much.			
Impact Extent	Local	Regional	National	
	The impact will occur at a local level only as the restrictions to land shall most likely impact people within 2 km of the site boundary in the two closest Makallas.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Low as the limited number of people who currently use the dirt tracks will be able to access alternative tracks or roads to reach their destination.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is Medium given that local communities and local herders rely on these pathways for access to livelihoods.			
	Negligible	Low	Medium	High

Impact Assessment: Impacts from a loss of public access to footpaths inside the project area	
Impact Significance	The impact is assessed as Low adverse, primarily because the local farm users may need to adapt and readjust to their new timings and distances compared to baseline conditions.

7.1.8.4 Reduced access to grazing and pastoral land

This impact will commence at the start of construction as working areas are fenced off to prevent unauthorised entry inside the site boundary. The change in land use in the Project area may result in change in local livelihoods mainly as a result of the reduction in available grazing area and reduction in income.

- Site clearing and grading will affect farming activities in the area.
- Transportation of waste from the site and materials and equipment by road may disrupt local livelihoods.

Within areas where construction works are ongoing, spatial impacts to access to grazing and pastoral land (in contrast to distance and time-altering impacts from the mobility impact above) will occur arising from a loss of access to grazing and pastoral land.

Impact Assessment: Reduced access to grazing and pastoral land				
Impact Nature	Positive		Negative	
	Impact is negative as existing land users shall experience a reduction of access to typical livelihood areas due to the restrictions in access to the land within the site boundary. No physical displacement will occur.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because the local makallas will no longer be able to access land inside the Project area during the Project life cycle. Resulting impacts are irreversible and land would only become available after project decommissioning.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is very long-term as land users will not be able to conduct pastoral activities inside the Project area from the moment fences are installed along the site boundary until the Project is decommissioned. The impact could have less duration after an alternative land is procured. As noted above from AECOM's discussion with the regional agricultural department, the Makhallas , the cadaster who knows the site well and the informal farmer on the site, the herders tend to use the area of land outside of the site to the north and only use the site itself on occasion if there is enough vegetation in spring. All people interviewed said the land is of such poor quality due to lack of irrigation that herders don't use it much.			
Impact Extent	Local	Regional	National	
	Impacts associated with a loss of access to land will likely only affect those within the Project AoI.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is medium as the impact is perceptible to the local farms and will represent a relevant change to their baseline conditions in terms of local grazing areas.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is Low for leaseholders along the OHTL given they will have sufficient land remaining and for herders who make use of alternative higher quality land.			
Impact Significance	Negligible	Low	Medium	High
	Based on the information available the impact is assessed as Low adverse, pre-mitigation.			

7.1.8.5 Increased presence of workers and interaction with local communities

Community H&S may be at risk from worker migration and the presence of workers in the Project area, resulting in a potential change in the disease profile of the local population. A more robust social baseline study will expand on communicable disease morbidity and crime incidence.

It is fundamentally important that the Project fully considers the COVID-19 risks as well as other communicable respiratory diseases, which will most likely be the most significant concern for potential interactions between the workforce and community members. Local workers may be exposed to potential COVID-19 risks where they are employed on the workers' camp. In turn this could result in further spread of COVID-19 back to the local community. A detailed assessment will be undertaken once more information on the workforce numbers, composition, and accommodation is available. While the full details of the workforce have not been provided yet, the mitigation measures to avoid and reduce risk exposure will be implemented, as detailed in the Interim Advice for IFC Clients on Preventing and Managing Health Risks of COVID-19 in the Workplace (IFC, 2020).

Impact Assessment: Increased presence of workers and interaction with local communities				
Impact Nature	Positive		Negative	
	This is an adverse impact because of the potential for people from outside the local area to turn up seeking employment and other types of economic opportunities. The Project workers will also be exposed to H&S risks. This may result in an increased risk and exposure to spreading communicable diseases, increased tensions between residents and newcomers, and may result in an increase in the local incidence of crime, in addition to potential surges of COVID-19 risks.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct and indirect because the Project will cause potential local employment that will attract direct and indirect opportunities and other potential worker migration. This is largely Reversible once the construction phase is concluded.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as community health and safety risks will be introduced from the start of the construction phase and although there will be residual risks throughout operation of the project, no significant worker migration is expected. Depending upon the type of incident and impact to human health, the duration could be medium-term. Workers' accommodation will further restrict the movement and interaction of workers with local communities outside the site, and the workers' camp will implement COVID-19 prevention measures within its quarters.			
Impact Extent	Local	Regional	National	
	Risks will be generated at a local level within the AoI.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium because the potential for workers to travel and interact with local residents may extend past the Project AoI. Both residents and workers may be exposed to increased health and safety risks.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the actual location of worker accommodation. Whereas Sherabad will have sufficient means to adapt, other localities such as may not have the same resilience to intake a large workforce or prevent their vulnerable groups from this potential increase to community H&S risks. Depending on the workforce composition, vulnerable worker population may be more sensitive to avoiding or treating communicable diseases, and this will have to be identified as a priority during the planning stage.			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, pre-mitigation.			

7.1.8.6 Increased presence of security personnel

In addition to the expected workforce, during the construction phase, private security personal shall be used to provide general security at construction working areas to ensure that there is no entry of unauthorised personnel and that construction equipment is safe and secure. There is the potential for security personnel to use excessive force that results in intimidation or even physical damage, acting as a trigger event to further potential conflicts and Human Rights risks.

Impact Assessment: Increased presence of security personnel		
Impact Nature	Positive	Negative
	This is an adverse impact because of the potential use of excessive force or intimidating presence of security guards that may interact with local herders or community members traveling near the Project site.	

Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because the Project will employ security personnel as part of its planned activities and to avoid access from local community members to other OHS risks inside the site.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as community health and safety risks will be largely limited to the construction phase.			
Impact Extent	Local	Regional	National	
	Risks will be generated at a local level within Project AoI.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium because the potential for security guards to interact with local community members is a very perceptible change to the baseline conditions of ample passage and access to the site area.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the timing of previous disclosure of Project starting activities.			
Impact Significance	Negligible	Low	Medium	Major
	The potential impact during construction is considered to be Medium adverse, pre-mitigation. It is expected that HR training and the full implementation of the Voluntary Principles on security and Human Rights, UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials, the UN Code of Conduct for Law Enforcement Officials and the International Code of Conduct on Private Security Providers will reduce this to Minor.			

7.1.8.7 Increased levels of gender-based violence, sexual exploitation and harassment

Baseline data has found that the three are generally relatively high levels of physical, sexual, economic and social violence in Uzbekistan, including sexual exploitation, domestic violence; gender disparities in higher and technical education; and a high female unemployment rate accompanied by a low proportion of women in leadership positions, particularly in for rural communities.

The construction and transportation sector are recognised as being amongst the industries most affected by HIV globally (WHO, 2018). This is attributed to the fact that construction work employs mainly young male, low skilled workers, the workforce is highly mobile, and the working and living conditions are conducive to engagement in casual sexual relationships, including with sex workers (WHO, 2018).. Therefore, Women (including vulnerable young girls) may be particularly at risk from the increased presence of local and migrant men looking for work opportunities near the Project AoI. The Project could contribute to this prevalence of GBVSEA in the following ways:

- Security personnel hired by the Project could abuse their positions of power through sexual violence and exploitation.
- Project workers could use their financial status to engage in sexual exploitation of local people, including vulnerable women and girls. This could be in the form of prostitution or other forms of transactional sex where money or gifts are used to exploit local people, including those who are vulnerable due to poverty and children.
- Project workers could exert domestic economic abuse over their family members, and particularly female spouses, because of the wages that they will earn during their Project employment.
- Domestic economic abuse associated with resettlement compensation, particularly withholding of financial payments from spouses.
- Project workers could engage in GBVSEH[126] of other Project workers, including those labourers in subordinate positions who come from local communities.

The receptor of this impact will be the children, women resident in communities located within the Project AoI, who have a High vulnerability.

[126] Gender-based Violence, Sexual Exploitation and Harassement

Impact Assessment: Increased levels of gender-based violence, sexual exploitation and harassment				
Impact Nature	Positive		Negative	
	This is an adverse impact because of the potential violence, exploitation and harassment of vulnerable groups such as women and children in all aspects of the Project.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct and indirect because the Project will employ Project workers directly and through subcontractors. It is largely reversible through the implementation of appropriate mitigation measures.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as it will be largely limited to the construction phase.			
Impact Extent	Local	Regional	National	
	The impact will be generated at a regional and local level.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is High as women and children are regarded as vulnerable receptors. .			
Impact Significance	Negligible	Low	Medium	Major
	The potential impact during construction is considered to be Major adverse, pre-mitigation. It is expected that the introduction of specific measures to prevent and address GBVSEH (as outlined in Section 8.8.1.9), will reduce this to Minor.			

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7.1.9 Transportation and Access

As stated in Section 2.4.5, it is estimated that up to 15,000 total vehicle movements will be expected to be carried out to/from the Project site. These numbers reflect what is anticipated to be required during the construction phase and may slightly decrease in number.

It is anticipated that the Project traffic will use a combination of national roads and motorways which are of low sensitivity, However, local roads near the Project AoI experience limited vehicle traffic and are used by pedestrians, bicycles, animals, vehicles for personal use (e.g. cars, small trucks) and livestock. Furthermore, it has been noted by international agencies that Uzbekistan has relatively poor road safety records with the majority of fatalities being drivers and pedestrians

The increase in traffic flow of larger vehicles, resulting from Project construction activities, will impact local road users and those receptors living and working alongside local roads in a number of ways:

- Increase in noise, vibration and dust creation;
- Increase in traffic and journey times;
- Disruption to businesses and day to day activities (e.g. livestock rearing);
- Accidental damage to community assets, crops and livestock which may lead to temporary loss of income; and
- Potential injuries to existing road users.

Those receptors living or working directly alongside local roads near the Project ste will be more adversely impacted.

Impact Assessment: Impacts on traffic during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased traffic volumes.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase construction traffic. The volume of traffic expect makes the impact likely to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent

Impact Assessment: Impacts on traffic during construction					
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site and on national roads in both Uzbekistan and Kazakhstan.				
Receptor Value / Sensitivity	Low		Medium	High	
	Although the transportation route passes a number of towns, the road is likely to have existing HGV traffic and the receptor sensitivity is determined to be low. At the local level, settlements are small with few amenities and sensitivity is expected to be High.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Low at the national and regional levels as the increased number of HGV movements is not expected to exceed 30% above baseline for major roads. At the local level, impacts are likely to be High given the hight volume of HGV traffic that is likely to use the local dirt roads on a regular basis.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact is assessed as Negligible at the national and regional level and not significant pre mitigation. Although no specific mitigation is required, standard good construction practice will be maintained to ensure no increase in predicted impacts during construction. At the local level potential impacts are assessed to be Medium and will require the project to prepare a traffic management plan to mitigate the impact, The plan will include safety measures such as a signals network and driving rules, measures to reduce the creation of dust, and community-related measures such as the use of the Grievance Mechanism for managing and rectifying cases where road users or local residents are injured as a result of Project traffic.				

7.1.10 Waste Management

Based on recent experience, AECOM expect that wastes will be disposed of at landfill. The EPC Contractor will provide details of the most suitable disposal site as part of detailed design but it is not expected that there are any recycling facilities at this landfill.

Impact Assessment: Impacts on waste during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities will result in increased waste volumes.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase both hazardous and non-hazardous wastes. This would include fuels, oils, inert construction waste and used, broken panels.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site, on the road to the landfill site and in the landfill site itself.				
Receptor Value / Sensitivity	Low		Medium	High	
	Although hazardous wastes will be produced, amounts are likely to be low and the landfill site confirms it can accept construction water. As a result the receptor sensitivity is determined to be low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Low as the increased volume is not deemed to be significant.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant. Standard good construction practice will be maintained to ensure no increase in predicted impacts during construction. Wastes will be segregated and stored appropriately. Although wastes would be landfilled at present, the				

Impact Assessment: Impacts on waste during construction	
	EPC Contractor will seek to identify appropriate recycling facilities should they become available.

7.2 Operational Impacts

7.2.1 Air Quality

Air pollution may also arise as a result of dust emanating from vehicle movements and other construction activity. However, this will be a temporary effect that can be mitigated by restricting vehicles to sealed access tracks and the use of dust suppression measures.

The Project impacts may include:

- Dust and engine emissions created by construction activities (i.e. earthworks, demolition and operation of machinery) could influence the local ambient air quality.
- The release of exhaust emissions to the atmosphere could have an effect on the local ambient air quality.

Impact Assessment: Impacts on air quality during operation					
Impact Nature	Positive		Negative		
	Impact is negative because construction activities may result in increased dust.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is direct as construction activities would directly increase air pollution.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and adjacent areas.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	Residential receptors are located 100 m of the Project site therefore receptor sensitivity is determined to be Medium.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Negligible as almost no ground disturbance will take place.				
Impact Significance	None	Negligible	Low	Medium	High
	Residential receptors are located 100 m of the Project site but lack of ground disturbance means the impact significance is deemed to be Negligible.				

7.7.1 Archaeology and Cultural Heritage

During the operational phase there will be no new impacts on existing cultural heritage receptors. Any archaeological remains that may have been present within the footprint of the Project will either have been removed in the course of archaeological mitigation works, or will be preserved in place. Operational impacts will be limited to impacts upon the setting of heritage receptors.

The Solar Array will continue to have a significant negative impact on the setting of recent Islamic cemetery **ACH119**. The Transmission Line will be visible from a number of heritage assets, including the ancient tepa settlement mounds that rise out of the surrounding irrigated lowlands. The Transmission Line will be an additional large-scale industrial element in a landscape already characterised by intensive large-scale agriculture and existing transmission lines and light industry south of Sherabad and west of Dzharkurgan. It will not affect the ability to appreciate the significance of the historic landscape, individual monuments or interrelationships and intervisibility between them. For this reason, the magnitude of impact on the setting of heritage assets is assessed as medium.

Impact Assessment: Impacts on archaeology and cultural heritage during operation					
Impact Nature	Positive		Negative		
	Operational impacts will be limited to setting of heritage assets.				
Impact Type	Direct		Indirect		
	These are direct impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
Impact Extent	Local		Regional	National	
	Impacts on archaeology are limited to Project footprint.				
Receptor Value / Sensitivity	Low	Medium	High		
	Any archaeological remains within the Project footprint will have been recorded and removed during the construction phase. However, the impact of the Solar PV Array on the setting of the high community value Islamic cemetery **ACH119** will persist throughout the operational life of the Project. The sensitivity for the heritage topic is therefore assessed as High.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	No works will be taking place other than maintenance and security. No physical impacts on archaeological remains are predicted. The new Transmission Line will impact on the setting of heritage assets. Setting impacts related to cemetery **ACH119** adjacent to the Solar Array site, are not capable of effective mitigation, resulting in a medium score for impact magnitude.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as medium prior to additional mitigation measures being implemented.				

7.2.2 Biodiversity

7.2.2.1 Avifauna

Summary (Baseline)

The proposed operational Overhead Line is not located on a major bottle neck or geographical feature that would concentrate migrating species. The Karasu river valley has a north-south orientation and therefore there is potential that this geographical feature functions as a migratory corridor linking the Amudarya River (including the Amudarya Floodlands IBA), to the south, with the Middle reaches of the Sherabad River IBA, to the north; the latter supports migratory flyway ornithological features of species/species groups which are particularly vulnerable to collision with powerlines. However, the narrow and shallow river valley, which dissects an extensive flat plain, is not a geographical feature which is likely to coerce northward or southward migrating raptors, storks and cranes into concentrated migration along the Karasu Valley; migration is likely to be on a broad front across the plain between the Amudarya River (flows along the Uzbekistan-Afghanistan border) and the Kelif-Sherabad Ridge upland area to the north. The results of the Sunscape 2020 and the AECOM 2022 field surveys (undertaken during the early and mid- spring passage periods, respectively) show that a number of IUCN threatened/Uzbekistan Red Book migratory species, which are particularly vulnerable to collision with powerlines, have been recorded as features of the AoI for the Overhead Line, however their respective populations are low and therefore insufficient to trigger critical habitat for Criterion 1 (Tiers 1 & 2): Egyptian vulture (IUCN [EN] & URDB [VU]), eastern imperial eagle (IUCN [VU] & URDB [VU]), little bustard (URDB [VU]); these are also PBF species (refer to Appendix D).

Survey work has confirmed that the AoI for the Overhead Line is not important for breeding or resident species, including the following IUCN threatened/Uzbekistan Red Book species of conservation concern which are particularly vulnerable to collision with powerlines: eastern imperial eagle (IUCN [VU] & URDB [VU]), Eurasian griffon vulture (URDB [VU] and cinerous vulture (URDB [VU]). The AECOM 2022 surveys confirmed the absence of Asian houbara (IUCN [VU]). These were recorded in low numbers and there is no reasonable likelihood that these populations are internationally or nationally significant.

Potential Impacts

Potential impacts to birds from the proposed operational Overhead Line are:

- Displacement of birds by the presence of new infrastructure (pylons, overhead wires), which may occur as both the deterrence of bird activity among and close to the pylons and also as a barrier effect to movement of birds across the Project area in the vicinity of new overhead wires;
- Permanent habitat loss, fragmentation and / or degradation resulting from the construction of new infrastructure;
- Increased bird mortality due to collision with new operational overhead line infrastructure; and
- Loss (mortality) of birds from electrocution from perching on the powerline infrastructure and risk of electrocution by large birds whilst flying (eg. raptors, storks and cranes).

Disturbance of birds from people and traffic during operational maintenance.

Impact Assessment

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Ornithology (PBF species) during Operation – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="2">Positive</td><td colspan="3">Negative</td></tr>
<tr><td colspan="5">Potential impacts during operation of the Project are:
• Displacement;
• Permanent habitat loss, fragmentation and / or degradation;
• Increased bird mortality due to collision
• Loss (mortality) of birds from electrocution

AECOM do not assess there to be an impact as a result of the so-called ‘lake effect’ of solar panels.

Routine inspections will record any bird fatalities in line with IFC guidance: Bird rescue protocol and monitoring at PV solar facilities.</td></tr>
<tr><td rowspan="2">Impact Type</td><td colspan="2">Direct</td><td colspan="3">Indirect</td></tr>
<tr><td colspan="5">The impacts listed above are all considered to be direct effects of Project operation.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Medium-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impacts will persist throughout operation and are therefore considered permanent.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td>National</td><td colspan="2">International</td></tr>
<tr><td colspan="5">The extent of potential operational impacts includes the operational Project footprint, including the 52km length of the proposed new 220 kV Overhead Line from the Solar PV to the grid connection point.

Given the distance between the Project site and the Amudarya River/Amudarya Floodlands IBA & Sherabad River IBA, and the lack of habitat connectivity or potential pathways between these internationally recognised sites and the Project site, there is no reasonable likelihood of significant direct or indirect impacts during the construction phase.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td><td>Very High</td></tr>
<tr><td colspan="5">The PBF bird species which have been recorded as present or assessed as having a reasonable likelihood of occurrence are not critical habitat qualifying species and are therefore not of very high or high sensitivity according to the criteria detailed above. In terms of the PBF species which have been recorded, these have been recorded in numbers which are not significant and are assigned a Medium sensitivity value. The occurrence of steppe eagle, Egyptian vulture, eastern imperial eagle and little bustard is likely to be restricted to overflying the AoI on spring and autumn migration. Resident raptor species (ie saker falcon,</td></tr>
</table>

<table>
<tr><th colspan="5">Impact Assessment: Impacts on Ornithology (PBF species) during Operation – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.</th></tr>
<tr><td></td><td colspan="4">Egyptian vulture, Eurasian griffon vulture, little bustard and lammergeier) may use the AoI for hunting/foraging, but saker falcon is the only potential nesting species of concern, although there were no records of this species from the baseline surveys (including nesting on existing pylons adjacent to the proposed Overhead Line route). There is no suitable cliff habitat which would provide opportunities for large raptors (eg. Egyptian vulture), at the Khaudag Ridge and other areas along the Overhead Line route. The Solar PV footprint does not support breeding populations for PBF bird species due to the unsuitability of the habitat.

Houbara bustard (IUCN [VU]) has been shown to be absent from the Solar PV and the Overline Line, as a result of the targeted surveys for this species undertaken by AECOM.

The PBF breeding bird sensitivity is determined as Low for the Solar PV and Overhead Line elements of the Project.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="4">Permanent loss and change of habitat for the Solar PV would be an effect of Negligible magnitude for the breeding, wintering and migratory birds which have determined to be PBF species .
. Permanent loss of habitat for the Overhead Line would be an effect of Low magnitude for breeding, wintering and migratory birds which may utilise habitat within the operational footprint , with only small areas are taken up by Overhead Line infrastructure (ie. pylon bases).

The operational Solar PV and Overhead Line will result in partial reduction of bird activity through the displacement of birds; this is assessed as Medium magnitude for PBF birds.

The 52km Overhead Line alignment is an extensive alignment in terms of migrating birds passing through the wider Surkandarya region on a broad front and it is orientated along an approximately east--west alignment, which increases the potential barrier effect of the power line/pylons with respect to birds migrating through the Project site south to north (in spring) or north to south (in autumn); an east-west alignment is potentially more impactful in this respect (compared to a north-south alignment). The magnitude of this potential impact is assessed as Medium for steppe eagle, Egyptian vulture, eastern imperial eagle and little bustard.

The Project Site is not sited on a migration bottle neck or High migration route; it is not located close to a mountain pass or wetland where large numbers of migratory birds could be concentrated or sited in an area where significant populations of species of conservation concern occur. The impact magnitude for collision of birds is therefore cautionary assessed as Medium, as the predicted mortalities for species of national and international concern are unlikely to be significant in the context of the Surxondaryo region or Uzbekistan national populations. The assessment does not take into account the probable reduction of bird activity resulting from displacement of birds around the proposed transmission line infrastructure, assuming instead that flight activity will continue unchanged during the operational period. Also, the assessment does not take into account that a proportion of bird flights will take avoiding action when flying towards the power line and therefore avoiding avoid collision with the power-line; assuming instead that all flights will result in a collision.

The proposed powerline is high voltage (220 kV) and therefore doesn’t typically present the same risk of electrocution to raptors and other large birds as some lower-voltage powerlines (eg. where the distribution conductor cables attached via relatively short insulators to poles constructed of conducting materials) of medium voltage (e.g. 1kV to 59kV). However, the precise configuration and dimensions of the electrical design is not yet available for this project. Species recorded during the baseline surveys which are potentially most vulnerable to electrocution, both in flight and from perching, due to their likely frequent presence within</td></tr>
</table>

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Ornithology (PBF species) during Operation – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.</th></tr>
<tr><td></td><td colspan="5">the project site (and also behavioural trait for perching whilst feeding, resting and hunting), are: long-legged buzzard (not of national or international conservation concern). The risk of electrocution to the large raptor PBF species is considered to be low due to their respective likely infrequent flight transits through the project area (in small numbers which are unlikely to be significant in terms of regional/national populations). The impact magnitude has been cautionary assessed as medium (overall) for electrocution.

The impact magnitude is assessed as Medium (overall) for the Overhead Line

The impact magnitude is assessed as Low for the Project</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The potential impact is assessed as Medium and significant for the Overhead Line

The potential impact is assessed as Low and not significant for the Solar PV.

Mitigation will be required to ensure impacts for the Overhead Line are not significant.</td></tr>
</table>

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Ornithology (non PBF species) during Operation</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="2">Positive</td><td colspan="3">Negative</td></tr>
<tr><td colspan="5">Potential impacts during operation of the Project are:
• Displacement;
• Permanent habitat loss, fragmentation and / or degradation;
• Increased bird mortality due to collision
• Loss (mortality) of birds from electrocution

AECOM do not assess there to be an impact as a result of the so-called ‘lake effect’ of solar panels.

Routine inspections will record any bird fatalities in line with IFC guidance: Bird rescue protocol and monitoring at PV solar facilities.</td></tr>
<tr><td rowspan="2">Impact Type</td><td colspan="2">Direct</td><td colspan="3">Indirect</td></tr>
<tr><td colspan="5">The impacts listed above are all considered to be direct effects of Project operation.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Medium-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impacts will persist throughout operation and are therefore considered permanent.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td>National</td><td colspan="2">International</td></tr>
<tr><td colspan="5">The extent of potential operational impacts includes the operational Project footprint, including the 50.5km length of the proposed new 220 kV Overhead Line from the Solar PV to the grid connection point.

Given the distance between the Project site and the Amudarya River/Amudarya Floodlands IBA & Sherabad River IBA, and the lack of habitat connectivity or potential pathways between these internationally recognised sites and the Project site, there is no reasonable likelihood of significant direct or indirect impacts during the construction phase.</td></tr>
</table>

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Ornithology (non PBF species) during Operation</th></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td><td>Very High</td></tr>
<tr><td colspan="5">All bird species which have been recorded as present or assessed as having a reasonable likelihood of occurrence are not critical habitat qualifying species and are therefore not of high sensitivity. A fairly diverse assemblage of overflying migratory, resident, winter visitors and summer breeding medium sized and large bird species are recorded within the Solar PV and Overhead Line AoI, including several species of national conservation concern; these have generally been recorded in numbers which are not significant and are assigned a Medium sensitivity value.

The Solar PV footprint supports a limited suite of breeding species associated with the mainly modified habitat. The Overhead Line crosses several discrete habitat areas of degraded natural habitat: Karasu River, Shuratakum Gorge and the Khaudag (the latter two areas will be subject to very localised habitat loss related to the construction of the pylons, whereas no direct habitat loss is anticipated within the riverine and riparian habitats at the Karasu river crossing). A small assemblage of ground nesting and shrub nesting passerines (small perching birds) utilise habitat within the Shuratakum Gorge and the Khaudag for nesting, foraging or resting; none of which are of international or national conservation concern. Houbara bustard (IUCN [VU]) has been shown to be absent from the Solar PV and the Overline Line, as a result of the targeted surveys for this species undertaken by AECOM. The sensitivity is determined as Low for all breeding bird species associated with the Solar PV and Overhead Line elements of the Project.

The Solar PV and the Overhead Line are assigned a Medium sensitivity overall in terms of the overflying (eg. migratory) bird assemblages which occur.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">Loss and change of habitat for the Solar PV would be an effect of Low magnitude for the breeding, wintering and migratory birds which utilise habitat within the working areas for breeding, roosting or foraging within the operational footprint of the Solar PV; a high proportion of the habitat will be covered by the solar panels. Loss of habitat for the Overhead Line would be an effect of Low magnitude for breeding, wintering and migratory birds which utilise habitat within the working areas for breeding, roosting or foraging, with only small areas are taken up by Overhead Line infrastructure (ie. pylon bases).

The operational Solar PV and Overhead Line will result in partial reduction of bird activity through the displacement of birds; this is assessed as Medium magnitude for the breeding, wintering and migratory bird assemblage. Human influences (primarily the land management) unique to each site. Consideration has been given to the Project site in terms that it is already characterised by a high level of anthropogenic disturbance (primarily due to farming activities and proximity to human habitation).

The 52km Overhead Line alignment is an extensive alignment in terms of migrating birds passing through the wider Surkandarya region on a broad front and it is orientated along an approximately east--west alignment, which increases the potential barrier effect of the power line/pylons with respect to birds migrating through the Project site south to north (in spring) or north to south (in autumn); an east-west alignment is potentially more impactful in this respect (compared to a north-south alignment). The magnitude of this potential impact is assessed as Medium.

The Project Site is not sited on a migration bottle neck or High migration route; it is not located close to a mountain pass or wetland where large numbers of migratory birds could be concentrated or sited in an area where significant populations of species of conservation concern occur. The impact magnitude for collision of birds is therefore cautionary assessed as Medium, as the predicted mortalities for species of national and international concern are unlikely to be significant in the context of the Surxondaryo region or Uzbekistan national populations. The assessment does not take into account the probable reduction of bird activity resulting from displacement of birds around the proposed transmission line</td></tr>
</table>

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Ornithology (non PBF species) during Operation</th></tr>
<tr><td></td><td colspan="5">infrastructure, assuming instead that flight activity will continue unchanged during the operational period. Also, the assessment does not take into account that a proportion of bird flights will take avoiding action when flying towards the power line and therefore avoiding avoid collision with the power-line; assuming instead that all flights will result in a collision.

The proposed powerline is high voltage (220 kV) and therefore doesn’t typically present the same risk of electrocution to raptors and other large birds as some lower-voltage powerlines (eg. where the distribution conductor cables attached via relatively short insulators to poles constructed of conducting materials) of medium voltage (e.g. 1kV to 59kV). However, the precise configuration and dimensions of the electrical design is not yet available for this project. Species recorded during the baseline surveys which are potentially most vulnerable to electrocution, both in flight and from perching, due to their likely frequent presence within the project site (and also behavioural trait for perching whilst feeding, resting and hunting), are: long-legged buzzard (not of national or international conservation concern). The risk of electrocution to cinerous vulture, osprey and white stork (all URDB species) is considered to be low due to their respective likely infrequent flight transits through the project area (in small numbers which are highly unlikely to be significant in terms of regional/national populations). The impact magnitude has been cautionary assessed as medium (overall) for electrocution.

The impact magnitude is assessed as Medium (overall) for the Overhead Line

The impact magnitude is assessed as Low for the Project</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The potential impact is assessed as Medium and significant for the Overhead Line

The potential impact is assessed as Low and not significant for the Solar PV.

Mitigation will be required to ensure impacts for the Overhead Line are not significant.</td></tr>
</table>

7.2.2.2 Terrestrial Ecology

<u>*Baseline (Summary)*</u>

Critical habitat requirements are applicable for the Project site with respect to the Tajikistan Toadhead Agama (*Phrynocephalus sogdianus*) (refer to Appendix D: Critical Habitat Assessment [Turnstone Ecology, 2022]).Tajikistan toadhead agama is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands. None were recorded in or around the Solar PV Site and habitats in this area are considered unsuitable. However, up to 30 individuals were found in sand dune/semi-fixed sand habitat in the vicinity of the Overhead Line route at the Khaudag Ridge during reptile surveys completed in April 2022. Habitats within the Overhead Line route in the Khaudag Ridge area are considered suitable for this species and are contiguous to the area where individuals were recorded in 2022.

A further three PBF reptile species were confirmed as present within the Project site as a result of the ecological field surveys: Central Asian tortoise (IUCN VU, URDB VU), black-oscellated racerunner (URDB VU) and tatar sand boa (URDB NT). An additional six reptile species are assigned PBF status when assessed against guidelines as set out in EBRD PR6 GN (refer to Appendix D): Boettiger Caspian toadhead agama, Transcaspian desert monitor, Indian gamma snake, Afghan awl-headed snake, northern (barred) wolf snake and southern even-fingered gecko. The latter species is listed by the IUCN as Critically Endangered (CR).

A single mammal of national conservation concern is confirmed present within a localised part of the Overhead Line (the Karasu River crossing): Brandt's hedgehog (URDB). Marbled polecat (IUCN VU & URDB) may also occur within the Project site, however there were no records of this species during the field surveys. Nevertheless, marbled polecat has been included as a PBF when assessed against guidelines as set out in EBRD PR6 GN.

A single individual of a flowering plant that is listed within the Red Data of Uzbekistan is present within the Solar PV site: *Chesneya tribuloides*.

<table>
<tr><th colspan="6">Impact Assessment: Impacts on a CH species: Tajikistan Toadhead Agama (Phrynocephalus sogdianus) – Critical Habitat has been triggered under IFC Criterion 1 and EBRD Criterion ii - during Operation</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="3">Positive</td><td colspan="2">Negative</td></tr>
<tr><td colspan="5">The types of potential effects on this faunal receptor from maintenance operations are broadly similar to those described for the aforementioned assessment of construction related disturbance, direct mortality/injury (vehicle collisions), population changes (hunting/take) and hydrological alteration of habitat. However, effect magnitudes would be expected to be lower during the operational phase due to the reduced level of human activity within the project site.</td></tr>
<tr><td rowspan="2">Impact Type</td><td colspan="3">Direct</td><td colspan="2">Indirect</td></tr>
<tr><td colspan="5">The impacts listed above are all considered to be direct effects of Project operation.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Medium-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impacts will persist throughout operation and are therefore considered permanent.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td>National</td><td colspan="2">International</td></tr>
<tr><td colspan="5">The impacts are expected to be restricted to the Project site where the Overhead Line crosses the Khaudag Ridge.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are applicable for Tajikistan toadhead agama. This species is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands and up to 30 individuals were found in sand dune/semi-fixed sand habitat in the vicinity of the Overhead Line route at the Khaudag Ridge during reptile surveys completed in April 2022. Habitats within the Overhead Line route in the Khaudag Ridge area are considered suitable for this species and are contiguous to the area where individuals were recorded in 2022. The EAAA used for the CHA has therefore been determined to include areas of suitable habitat that are likely contiguous with the Overhead Line route which are not separated or modified by agriculture or urbanisation; it is calculated to be 250km^2 (refer to Appendix D). This species is therefore assigned a ‘High’ sensitivity value for the Overhead Line element of the project.

None were recorded in or around the Solar PV Site and habitats in this area are considered unsuitable; the Solar PV does not support sand dune habitat required by this species. Tajikistan toadhead agama is therefore assigned a ‘Negligible’ sensitivity value for the Solar PV element of the project.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">This species is likely absent from the Solar PV site so the magnitude of impact for this element of the project is Negligible.

The magnitude of the impact for the <u>Overhead Line</u> is expected to be <u>Low</u> for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag Ridge. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed</td></tr>
</table>

Impact Assessment: Impacts on a CH species: Tajikistan Toadhead Agama (*Phrynocephalus sogdianus*) – Critical Habitat has been triggered under IFC Criterion 1 and EBRD Criterion ii - during Operation					
	as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Medium and significant for the Overhead Line crossing of the Khaudag Ridge and None for the Solar PV element of the project. There is a requirement for the project to achieve Net Gains for this Critical Habitat qualifying species. The mitigation measures required to achieve net gain will be detailed within a Biodiversity Action Plan (BAP) for the species.				

Impact Assessment: Impacts on Smooth Even-fingered Gecko (*Alsophylax laevis*), a Critically Endangered Species - during Operation					
Impact Nature	Positive	Negative			
	The types of potential effects on this faunal receptor from maintenance operations are broadly similar to those described for the aforementioned assessment of construction related disturbance, direct mortality/injury (vehicle collisions), population changes (hunting/take) and hydrological alteration of habitat. However, effect magnitudes would be expected to be lower during the operational phase due to the reduced level of human activity within the project site.				
Impact Type	Direct	Indirect			
	The impacts listed above are all considered to be direct effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local	Regional	National	International	
	The impacts are expected to be restricted to the Project site.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are not applicable for southern even-fingered gecko, however this species is listed as Critically Endangered by the IUCN and is assigned a High significance.				
Impact Magnitude	Negligible	Low	Medium	High	
	Magnitude is assessed as Negligible for this species as neither the Solar PV site or OHTL offer suitable habitat. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site. The magnitude of the impact for the Overhead Line is expected to be Negligible for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no operational impacts are expected for this sensitive habitat area for smooth even-fingered gecko. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is				

Impact Assessment: Impacts on Smooth Even-fingered Gecko (*Alsophylax laevis*), a Critically Endangered Species - during Operation					
	assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant overall. .				

Impact Assessment: Impacts on other PBF species: Central Asian tortoise, Boettiger Caspian toadhead agama, black ocellated racerunner, Transcaspian desert monitor, Indian gamma snake, Afghan awl-headed snake, northern (barred) wolf snake, tartar sand boa and marbled polecat					
Impact Nature	Positive	Negative			
	The types of potential effects on PBF faunal receptors) from maintenance operations are broadly similar to those described for the aforementioned assessment of construction related disturbance, direct mortality/injury (vehicle collisions), population changes (hunting/take) and hydrological alteration of habitat. However, effect magnitudes would be expected to be lower during the operational phase due to the reduced level of human activity within the project site.				
Impact Type	Direct	Indirect			
	The impacts listed above are all considered to be direct effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local	Regional	National	International	
	The impacts are expected to be restricted to the Project site.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	Very High
	These PBF reptile species are assigned a Medium value due to their presence or potential presence within the Project AoI and their respective inclusion as species listed on the Red Data Book of Uzbekistan. Marbled polecat is assigned Vulnerable status by IUCN. All PBF faunal species present or potentially present within the Project AoI are assigned Medium value for both elements of the Project (ie. Solar PV and Overhead Line).				
Impact Magnitude	Negligible	Low	Medium	High	
	A high proportion of the habitat will be permanently covered by the solar panels bases and therefore the magnitude of the effect is predicted to be precautionarily assessed as Medium (overall) for terrestrial ecology. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality of fauna and *Chesneya tribuloides* due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site. The magnitude of the impact for the Overhead Line is expected to be Low for terrestrial ecology, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small, including the Khaudag sensitive reptile area. There will be no loss of				

	riparian habitat at the Karasu River crossing; therefore, no operational impacts are expected for this sensitive reptile habitat. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline. In terms of potential collision risk to bats for the OHTL element of the project, the proposed powerline line is not routed through suitably favourable habitat (eg. woodland edge or linear wetland feature) that may be used regularly for commuting and / or foraging (e.g. commuting to and from a building roost to a foraging area between which the overhead line was located) there would be a theoretical collision risk to bats. Bats are extremely agile flyers and have a highly developed echolocation system which they use for navigation and prey capture; the species that could be present are able to fly through and negotiate complex environments including foraging around tree canopies and building complexes. Therefore, due to their highly developed flight skills and the relatively static nature of the powerlines, there would be a negligible collision risk posed by the proposed overhead line.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Medium for the Solar PV and therefore significant. The impact is assessed as Low for the operational Overhead Line and not significant. A suite of both standard mitigation measures and species-specific mitigation measures will be implemented to ensure impacts are not significant.				

Impact Assessment: Impacts on Terrestrial Species (other than species which have been assessed as PBFs) during Operation					
Impact Nature	Positive			Negative	
	The types of potential effects on faunal receptors (including Central Asian tortoise) from maintenance operations are broadly similar to those described for the aforementioned assessment of construction related disturbance, direct mortality/injury (vehicle collisions), population changes (hunting/take) and hydrological alteration of habitat. However, effect magnitudes would be expected to be lower during the operational phase due to the reduced level of human activity within the project site.				
Impact Type	Direct			Indirect	
	The impacts listed above are all considered to be direct effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Terrestrial Species (other than species which have been assessed as PBFs) during Operation</th></tr>
<tr><td></td><td colspan="5">The impacts will persist throughout operation and are therefore considered permanent.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td>Local</td><td>Regional</td><td>National</td><td colspan="2">International</td></tr>
<tr><td colspan="5">The impacts are expected to be restricted to the Project site.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td><td>Very High</td></tr>
<tr><td colspan="5">All non-PBF faunal species present or potentially present within the AoI are assessed as not exceeding medium value and are assigned Negligible-Medium value.

The Uzbekistan Red Listed flowering plant Chesneya tribuloides is also assigned a Medium value for the operational Solar PV site, as it is assumed that the plant, which grows on the steep-sloped periphery of the site, will be undisturbed retained during the construction phase and therefore will be retained in situ within the operational solar farm design (ie. it is assumed that the steep slopes of the western escarpment are unsuitable for solar panels or other solar farm infrastructure/access roads and will not be impacted by earthworks).

No habitat types or ecosystems were present or identified as being potentially present for the Solar PV/Overhead Line that would be considered as priority habitats as such Criterion 1: Threatened Habitat (PBF guidelines as set out in EBRD PR6 GN) [refer to Appendix D: Critical Habitat Assessment Report [Turnston Ecology, 2022)]. However, fragmented areas of Natural Habitat (degraded) occurs within the Solar PV and the Overhead Line crosses the Shuratakum Gorge, Karasu River and Khaudag Ridge, which also support Natural Habitat (degraded). Therefore a Medium sensitivity is assigned for the Soalr PV and Overhead Line.

Therefore, the overall value for sensitivity of the terrestrial ecological receptors is Medium (overall) for both elements of the Project (ie. Solar PV and Overhead Line).</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">A high proportion of the habitat will be permanently lost for the solar panel bases and therefore the magnitude of the effect is predicted to be precautionarily assessed as <u>Medium (overall)</u> for terrestrial ecology. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality of fauna and Chesneya tribuloides due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site.

The magnitude of the impact for the <u>Overhead Line</u> is expected to be <u>Low</u> for terrestrial ecology, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small, including the Khaudag sensitive reptile area. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no operational impacts are expected for this sensitive reptile habitat. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline.

In terms of potential collision risk to bats for the OHTL element of the project, the proposed powerline line is not routed through suitably favourable habitat (eg. woodland edge or linear wetland feature) that may be used regularly for commuting and / or foraging (e.g. commuting to and from a building roost to a foraging area between which the overhead line was located) there would be a theoretical collision risk to bats. Bats are extremely agile flyers and have a highly developed echolocation system which they use for navigation and prey capture; the species that could be present are able to fly through and negotiate complex environments including foraging around tree canopies and building complexes. Therefore, due to their</td></tr>
</table>

Impact Assessment: Impacts on Terrestrial Species (other than species which have been assessed as PBFs) during Operation					
	highly developed flight skills and the relatively static nature of the powerlines, there would be a negligible collision risk posed by the proposed overhead line.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Medium for the Solar PV and therefore significant. The impact is assessed as Low for the operational Overhead Line and not significant. A suite of both standard mitigation measures and species-specific mitigation measures will be implemented to ensure impacts are not significant.				

7.2.3 Geology and Soils

During this phase of the Project, the main impacts on soils would be from continued vehicle traffic. Vehicle movements will comprise:

- Movement of staff and materials to and from the site along the access roads.
- Movements between the control centre and across the site for operation and maintenance. Workers are expected to visit the site at least once per week for routine maintenance.

There should be no need for vehicles to travel off the improved roads, and this should be actively discouraged. As described with regard to the construction phase impacts, the main risk to soils would be where vehicles leave prepared roads and drive cross-country. If designated roads are not used, vehicle movements can cause damage over a wide area.

Impact Assessment: Impacts on soil quality during operation					
Impact Nature	Positive		Negative		
	The main operational impacts on soils would be from continued vehicle traffic. Vehicle movements will comprise: Movement of staff and materials to and from the site along the access roads. Movements between the control centre and across the site for operation and maintenance. Workers are expected to visit the site at least once per week for routine maintenance. Risk of pollution from solid, liquid and hazardous wastes and leaks and spills from maintenance activities.				
Impact Type	Direct		Indirect		
	These are indirect impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local	Regional	National		
	The impacts on geology and soils are primarily limited to the footprint of the Project.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The soils are considered to have a low sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect during operation is very low, since there will be much less frequent traffic than during construction, and only occasional use of heavy equipment. In addition, the use/handling of chemicals /oils/wastewater during operation will be limited.				
Impact Significance	None	Negligible	Low	Medium	High
	The impacts are assessed as Negligible and insignificant.				

7.2.4 Glare and Glint

The potential for glare and glint from the Project during operation is low. It is important to note that the PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. The PV panels that will be used for the Project have very limited levels of either glint or glare and are substantially less reflective than most surfaces such as still water, glass or steel. Glint will be substantially reduced by the anti-reflective coating of the modules that is incorporated to maximise the light capture of the solar cells.

Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation.[127]

Impact Assessment: Glint and glare impacts during operation					
Impact Nature	Positive	Negative			
	There is a perception that solar PV panels (in a similar way to glass buildings and large metal structures) can cause significant solar reflections that can cause a distraction or nuisance. This can be an important concern for airports and highways particularly when located in the pilot's direct field of vision on approach to the runway.				
Impact Type	Direct	Indirect			
	This is a direct impact resulting from sunlight reflecting off the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	Any glint and glare issues would persist throughout operation.				
Impact Extent	Local	Regional	National		
	Any impacts would be limited to areas in relatively close proximity to the site.				
Receptor Value / Sensitivity	Low	Medium	High		
	There are safety concerns with regard to any potential to distract aircraft pilots and vehicle drivers, causing accidents leading to potential injuries or deaths.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation. The site is not close to or located on a flight path to and from a local airport.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant.				

7.2.5 Hydrology and Hydrogeology

Potential impacts to surface waters by operating activities would include pollution, increased runoff and erosion, primarily in existing or new erosion channels that receive run-off from roads. The sensitivity of surface water is assessed as medium, recognising the fact that a small number of local residents use the two watercourses adjacent to the site for drinking water for livestock. The sensitivity of groundwater is assessed as medium as no local communities abstract groundwater for domestic use from local wells.

The magnitude of the effect is predicted to be low given the limited area of the Project site in relation to the overall catchment area. As a result, the significance of the impact is assessed as low.

[127] Federal Aviation Administration (FAA), July 2015. Final Report: Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach.

The source of water required for construction has not yet been determined however the EPC is consulting with the water authority.

Potential sources of pollution to groundwater during operation include sanitary waste and leaks and spills from maintenance activities.

<table>
<tr><th colspan="6">Impact Assessment: Hydrology and hydrogeology impacts during operation</th></tr>
<tr><td rowspan="2">Impact Nature</td><td colspan="2">Positive</td><td colspan="3">Negative</td></tr>
<tr><td colspan="5">Impacts on surface water would include increased runoff and erosion, primarily in existing or new erosion channels that receive run-off from roads. Surface and ground water are also at risk of pollution from solid, liquid and hazardous wastes and leaks and spills from maintenance activities.</td></tr>
<tr><td rowspan="2">Impact Type</td><td colspan="2">Direct</td><td colspan="3">Indirect</td></tr>
<tr><td colspan="5">Pollution due to increased run-off, leaks, spillages and waste mismanagement are all considered to be indirect effects of Project operation.</td></tr>
<tr><td rowspan="2">Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Medium-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td colspan="5">The impact will persist throughout operation and is therefore considered permanent.</td></tr>
<tr><td rowspan="2">Impact Extent</td><td colspan="2">Local</td><td>Regional</td><td colspan="2">National</td></tr>
<tr><td colspan="5">Impacts anticipated to be limited to the local area, primarily adjacent wetland areas and local communities.</td></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td colspan="2">Medium</td><td>High</td></tr>
<tr><td colspan="5">The sensitivity of surface water is assessed as medium, recognising that the canals are a source of irrigation water. The sensitivity of groundwater is assessed as low, recognising the fact that no local communities will abstract groundwater for domestic use during operation.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>No change</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The magnitude of the effect in relation to surface water is predicted to be low given the limited area of the Project site in relation to the overall catchment area.
The magnitude of the effect in relation to groundwater is predicted to be low, given that the soil and superficial deposits present in the area are expected to provide protection to the groundwater, and that the use/handling of chemicals /oils/wastewater during operation will be limited.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">Pre-mitigation, the impact in relation to surface water is assessed as low, due to the limited extent.
Pre-mitigation, the impact in relation to groundwater is assessed as low and not significant.</td></tr>
</table>

7.2.6 Labour and Working Conditions

A sound worker-management relationship is a key requirement of the Project and a constructive worker-management relationship, by treating the workers fairly and providing them with safe and healthy working conditions, is required to ensure protection of the fundamental rights of workers.

The implementation of the actions necessary to meet these requirements will be managed through the Project's Environmental and Social Management System (ESMS).

The requirements apply to workers directly engaged by the client (direct workers), workers engaged through third parties to perform work related to the Project.

The aim of the Project's policies on labour and working conditions will be:

To promote the fair treatment, non-discrimination, and equal opportunity of workers especially vulnerable workers facing particular risks due to context-specific socioeconomic characteristics.

- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labor laws.
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- To promote safe and healthy working conditions, and the health of workers.

- Zero tolerance for the use of forced labour and child labour.

Respecting the principles of freedom of association and collective bargaining.

Ensuring that accessible and effective means to raise and address workplace concerns are available to workers.

During the operation phase, there may be occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. Key risks could include, *inter alia*, collision with vehicles and plant and exposure to a variety of hazards such as electric shock from exposed cables and thermal burn hazards and exposure to chemicals, hazardous or flammable materials.

Labour and working conditions, including occupational health and safety impacts, are considered to be of long-term duration throughout the lifetime of the project and are expected to be of potential high magnitude and high sensitivity as in extreme cases they could entail permanent impacts (e.g. death or permanent disability). As such, the impacts are considered to be of High impact and appropriate mitigation will be developed.

Impact Assessment: Occupational health and safety impacts during operation					
Impact Nature	Positive			Negative	
	There will be a range occupational health and safety risks throughout operational activities. This includes electrocution, thermal burn hazards, exposure to hazardous chemicals and working in extreme temperatures. Mismanagement of wastes (such as domestic solid waste, sewage and hazardous wastes) can also represent a health and safety risk to workers, such as disease, injury or death.				
Impact Type	Direct			Indirect	
	The risks are predominantly associated with direct impacts on the operational and maintenance workers due to the operation of the Project. Health and safety risks associated with waste mismanagement are considered indirect impacts. The Project's policies on labour and working conditions will further impact worker's income and wellbeing.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout the operation and are therefore considered long-term.				
Impact Extent	Local		Regional	National	
	The impacts will be limited to the project site and local area.				
Receptor Value / Sensitivity	Low	Medium		High	
	The receptors in this case are the operational workers. There are likely to be approximately 25 workers and all are considered high value/sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Occupational health and safety impacts could result in disease, injury, or death to workers and so the magnitude is high.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact is assessed as High and significant. An independent Labour Assessment shall be undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors.				

7.2.7 Landscape and Visual Impacts

The Project will cover 631 hectares of land but the majority of the Solar Park is less than 3m in height and there is limited potential for the project to have a High impact on the people living in the local residential properties to the north and east of the project site. Residents to the west and south west are likely to experience more expansive views of the project for the lifetime of operation.

Impact Assessment: Landscape and visual impacts during operation		
Impact Nature	Positive	Negative

Impact Assessment: Landscape and visual impacts during operation					
	The introduction of large-scale infrastructure has potential for impacts that would be perceived by some as being detrimental.				
Impact Type	Direct	Indirect			
	Impacts can be direct (the introduction of the Project changes the landscape itself) or indirect (when the Project affects views from other adjacent or more distant landscapes).				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact will persist throughout operation and is therefore considered permanent.				
Impact Extent	Local	Regional	National		
	Given the low height of solar arrays (approximately 2.4 m) and the screening offered by surrounding topography (particularly to the east) and vegetation, potentially significant effects will generally be restricted to the local area.				
Receptor Value / Sensitivity	Low	Medium	High		
	The local landscape is already altered due to the presence of man-made structures such as overhead power lines, main highway, existing electricity substation and other commercial structures. Sensitivity is also reduced by anthropogenically altered watercourses. The whole area was farmed in Soviet times and it is only in the past decade that the level of farming has been reduced, most likely due to poor soil quality. However, receptors in proximity to the site are predominately related to residential settlement. The one exception is the cemetery which is considered Medium.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of change is assessed to be Medium as the Project will introduce a notable change to the landscape, particular to VP1 in closest proximity to the Project site but this will be on a very localised level.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the effect is assessment as Medium and significant.				

7.2.7.1 Glare and Glint

The potential for glare and glint from the Project during operation is low. It is important to note that the PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. The PV panels that will be used for the Project have very limited levels of either glint or glare and are substantially less reflective than most surfaces such as still water, glass or steel. Glint will be substantially reduced by the anti-reflective coating of the modules that is incorporated to maximise the light capture of the solar cells.

Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation.[128]

Impact Assessment: Glint and glare impacts during operation					
Impact Nature	Positive	Negative			
	There is a perception that solar PV panels (in a similar way to glass buildings and large metal structures) can cause significant solar reflections that can cause a distraction or nuisance. This can be an important concern for airports and highways particularly when located in the pilot's direct field of vision on approach to the runway.				
Impact Type	Direct	Indirect			
	This is a direct impact resulting from sunlight reflecting off the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	Any glint and glare issues would persist throughout operation.				
Impact Extent	Local	Regional	National		
	Any impacts would be limited to areas in relatively close proximity to the site.				

[128] Federal Aviation Administration (FAA), July 2015. Final Report: Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach.

Impact Assessment: Glint and glare impacts during operation					
Receptor Value / Sensitivity	Low	Medium	**High**		
	There are obvious safety concerns with regard to any potential to distract aircraft pilots and vehicle drivers, causing accidents leading to potential injuries or deaths.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation.				
Impact Significance	None	Negligible	**Low**	Medium	High
	The impact is assessed as Low and not significant.				

7.2.8 Noise

General EHS Guidelines sets out noise limits for industrial areas, commercial areas, residential areas and construction. The relevant limit is therefore shown as the residential limit of 45dB(A) for night time. At levels above these criteria the noise emissions from the Project would be considered to have a significant effect.

Solar PV panels themselves do not provide a noise source during operation, however equipment within the site (typically inverter stations and transformers) will emit noise during operation. While the Project will only be operational during daylight hours, as the transformers are permanently energised, they may emit some noise by way of magnetostriction hum during night-time. The distance between the substation transformers and the nearest residential properties is assumed to be approximately 500 m, although this will be confirmed as part of the ESIA.

For the purposes of this assessment it is assumed that the substation transformer is the dominant source of noise as the other sources (transformer and invertor stations) are over 200 m from the closest receptor.

No breach of the lower 45 dB limit is considered to be likely, although this will be confirmed as part of the ESIA.

Impact Assessment: Noise impacts during operation					
Impact Nature	Positive	**Negative**			
	Solar PV panels themselves do not provide a noise source, however equipment within the site (typically inverter stations and transformers) will emit noise during operation. While the Project will only be operational during daylight hours, as the transformers are permanently energised, they may emit some noise by way of magnetostriction hum during night-time.				
Impact Type	**Direct**	Indirect			
	Noise received at nearby receptors would be considered a direct impact of the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	**Permanent**
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	**Local**	Regional	National		
	Operational noise impacts will be restricted to an area immediately adjacent to the Project.				
Receptor Value / Sensitivity	Low	Medium	**High**		
	There are settlements in relatively close proximity to the Project, receptors are of high sensitivity.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	The distance between the transformers and the nearest residential properties is considered sufficient to reduce any noise to an acceptable level, however the substation is in close				

Impact Assessment: Noise impacts during operation					
	proximity to receptors. Noise calculations have deemed operational noise to be within specified limits. A negligible magnitude of change is therefore predicted.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant.				

7.2.9 Socio-economic Impacts

Potential socio-economic impacts during operation of the Project are largely similar to the Construction phase, with reduced impact Magnitudes and Significance.

The following potential impacts for the operation phase were considered as the most relevant for the AoI and the socio-economic receptors:

- Impacts on land and livelihoods from land occupied by the project area.
- Impacts from local employment during operation.
- Impacts on the national and regional economy during operation.
- Potential for gender-based violence, sexual exploitation and harassment.

7.2.9.1 Impacts on land and livelihoods from land occupied by the project area

Impacts to land and livelihoods will be mitigated and completed prior to construction works. No other related impacts are expected to take place during the operational phase.

7.2.9.2 Impacts from local employment during operation

The number of local people that are to be employed during operation are expected to comprise of a mix of Uzbek nationals working for the Proponent, in addition to personnel provided through local subcontractors to provide a range of supporting services, including security.

As the project transitions from construction into operation, there will be a shift in the skills required. Consequently, it will be necessary to develop the skills of local people during construction so that suitable individuals are able to take up the long-term (potentially 20 years) positions during operations.

The individuals employed and their household members, will benefit from increased income that is likely to increase their overall quality of life and access to healthcare, educational and other types of resources across a longer time frame. The household is also expected to experience increased resilience to external shocks from the supply of income, that could arise from a sudden change in health status or external factor such as food price inflation.

Impact Assessment: Impacts from local employment during operation					
Impact Nature	Positive	Negative			
	The impact during operations is positive.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is both direct and indirect because the individuals and their household members are expected to benefit from an increase in standard of living and reduced vulnerability to external shocks. The impact is reversible as the income generated from local employment shall cease at the end of their employment at the end of the operational phase (20 years).				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The period of employment will continue over the lifetime of the Project which is 20 years.				
Impact Extent	Local	Regional	National		
	The impact will occur at a local level amongst the communities where employees are based.				
Impact Magnitude	Negligible	Low	Medium	High	
	The impact magnitude is low as the workforce required during operations is relatively small when compared to the construction stage.				
	Negligible	Low	Medium	High	

Impact Assessment: Impacts from local employment during operation				
Receptor Value / Sensitivity	The sensitivity is high as local employment during both construction and operations is a key expectation amongst local communities and their representatives. It is essential that Uzbeks comprise a significant component of the operational workforce.			
Impact Significance	Negligible	Low	**Medium**	High
	As a result of the above, the overall impact is assessed as Medium and positive.			

7.2.9.3 Impacts on the national and regional economy during operation

Operation of the Project shall generate up to 200 MW of renewable energy which shall be fed into the national grid. The Proponent shall also make annual tax payments to central government in parallel with the generation of revenue.

During operations, there will also be an ongoing demand for general support from other national and regional businesses, such as consulting, legal, and accounting using small to medium enterprises.

Impact Assessment: Impacts on the national and regional economy during operation					
Impact Nature	**Positive**	Negative			
	Impact is positive because the operation of the Project will generate energy, which is fed into the national grid, contributing towards the ongoing development of the country which is currently severely lacking in energy generation.				
Impact Type	**Direct**	**Indirect**	**Reversible**	Irreversible	
	The impact is both direct and indirect because the company will provide energy to the national grid which will benefit other electricity users (households, businesses and government buildings), pay taxes, purchase materials and services which will lead to the growth of small and medium business. The impact is reversible as it will only continue during operation.				
Impact Duration	Temporary	Short-term	Medium-term	**Long-term**	Permanent
	The impact is long-term because it would continue throughout the whole period of project operation of 20 years.				
Impact Extent	Local	**Regional**	**National**		
	The impact will occur at a regional and national level as energy shall be injected into the national grid. The local communities shall not be provided with electricity as this is the responsibility of the offtaker.				
Impact Magnitude	Negligible	Low	**Medium**	High	
	The impact magnitude is medium as the quantity of energy generated by the project is an important contribution at 200MW.				
Receptor Value / Sensitivity	Negligible	Low	**Medium**	High	
	The sensitivity is medium as the countries' energy demand shall continue to increase during the lifespan of the project.				
Impact Significance	Negligible	Low	**Medium**	High	
	The overall impact significance is Medium and positive.				

7.2.10 Potential for of gender-based violence, sexual exploitation and harassment impacts

Although the number of project workers will reduce considerably during operation, the impact of GBVSEH on members of the community may remain. The Project could contribute to this prevalence of domestic and non-domestic violence and GBVSEH through:

- Any security personnel hired by the Project for protecting stations or other Project facilities could act violently when interacting with local community members, including physical and sexual violence as well as coercion and threats.
- Project workers could exert domestic economic abuse over their family members, and particularly female spouses, because of the wages that they will earn during their Project employment. This is anticipated to be less of a risk during operations compared to construction due to the lower numbers of workers and the long-term, stable nature of the income earnt during operations.

- Project workers could use their financial status to engage in sexual exploitation of local people, including vulnerable women and girls. This could be in the form of prostitution or other forms of transactional sex where money or gifts are used to exploit local people, including those who are vulnerable due to poverty and children.
- Project workers could engage in GBVSEH of other Project workers, including those insubordinate positions.

The receptors of this impact will be the children, women resident in communities located within the Project AoI, who have a High vulnerability.

Impact Assessment: Increased levels of gender-based violence, sexual exploitation and harassment				
Impact Nature	Positive		Negative	
	This is an adverse impact because of the potential violence, exploitation and harassment of vulnerable groups such as women and children in all aspects of the Project.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct and indirect because the Project will employ Project workers directly and through subcontractors. It is largely reversible through the implementation of appropriate mitigation measures.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as the mitigation measures would help to identify any violence and GBVSEH-related impacts and allow the Project to put in place corrective actions, rather than allow them to continue long-term.			
Impact Extent	Local	Regional	National	
	The impact will be generated at local level.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Low.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is High as women and children are regarded as vulnerable receptors. .			
Impact Significance	Negligible	Minor	Medium	Major
	The potential impact during operation is considered to be Medium adverse, pre-mitigation. It is expected that the continued implementation of specific measures introduced during the construction phase to prevent and address GBVSEH (as outlined in Section 8.8.1.9), will reduce this to Minor.			

7.2.11 Transportation and Access

The main transport impacts will occur during the construction phase. The number of vehicles during operation is likely to be very low, with access required only for maintenance and servicing. The majority of these will be light vehicles and, at the worst case, a HGV trip may be required to transport a replacement transformer to site. The effects of traffic movements stemming from the operational phase are therefore considered Negligible and so insignificant.

7.2.12 Waste Management

Based on recent experience, AECOM expect that wastes will be disposed of at landfill. The EPC Contractor will provide details of the most suitable disposal site as part of detailed design but it is not expected that there are any recycling facilities at this landfill.

Impact Assessment: Impacts on waste during construction				
Impact Nature	Positive		Negative	
	Impact is negative because construction activities will result in increased waste volumes.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct as operational activities would directly increase both hazardous and non-hazardous wastes. This would include fuels, oils and used, broken panels.			

Impact Assessment: Impacts on waste during construction						
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent	
	The impact is long-term as impacts would occur during the full operational phase.					
Impact Extent	Local	Regional	National			
	The impact is expected to occur within the site, on the road to the landfill site and in the landfill site itself.					
Receptor Value / Sensitivity	Low	Medium	High			
	Although hazardous wastes will be produced, amounts are likely to be low and the landfill site confirms it can accept such waste. As a result the receptor sensitivity is determined to be low.					
Impact Magnitude	No change	Negligible	Low	Medium	High	
	Magnitude of change is anticipated to be Negligible as the increased volume is not deemed to be significant.					
Impact Significance	None	Negligible	Low	Medium	High	
	The impact is assessed as Negligible and not significant. Wastes will be segregated and stored appropriately. Although wastes would be landfilled at present, the EPC Contractor will seek to identify appropriate recycling facilities, including for broken solar panels.					

7.3 Decommissioning Impacts

7.3.1 Air Pollution

The change in ambient air quality may arise at decommissioning as a result of fugitive dust and particulate matter emissions. However, such impacts are expected to be temporary and of short-term nature as they are limited to the decommissioning phase only. The impacts will be similar to the construction phase.

7.3.2 Biodiversity

Similar to construction, the main impacts during decommissioning are likely to comprise disturbance to birds. Following decommissioning, reinstatement will be important to re-establishing the ecosystem in areas previously occupied by solar panels, site roads and other structures. At the time of decommissioning, the sensitivity of some species, particularly those which are regionally rare, may have increased.

7.3.3 Geology and Soils

Similar to construction, soils will be highly vulnerable to traffic and erosion during decommissioning. The movement of materials off-site may involve the construction of temporary roads and use of large vehicles. There is also potential for chemical or oil spills, or the incorrect handling/disposal of wastes during decommissioning. Similar measures to those outlined for the construction phase will need to be taken to minimize impacts on soils. Reinstatement of land and after-care will be critical to mitigating the damage to soils.

The panels and supports will be dismantled and steel and other useful materials will be recycled. Inert materials which cannot be recycled will be taken to a suitable disposal site. However, foundations and other inert belowground materials will be buried. This is not likely to have a significant impact on soils as it will not prevent re-vegetation or restoration of land.

7.3.4 Hydrology and Hydrogeology

Effects on water resources during decommissioning are likely to be similar to those during construction, so sensitive features such as drainage channels would need to be avoided. Contaminated materials such as oil storage tanks would need to be removed from the site and taken to a suitable disposal site to prevent future contamination of surface and groundwater.

7.3.5 Labor and working conditions

Similar to construction, the use of a workforce and decommissioning activities could potentially generate a variety of risks to the workforce, due to general site decommissioning activities (removal of site equipment and infrastructure) and the presence of project vehicles on local risks posing a risk to. As per the construction phase, an independent Labour Assessment shall be undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors.

Also, an Occupational Health and Safety Plan, Traffic Management Plan and Emergency Response Plan will be in place for the decommissioning phase of the Project. Appropriate policies will be in place to protect worker's rights.

7.3.6 Landscape and visual

Impacts of landscape will result from removal of solar PV panels, substations and transformer stations, on-site and off-site transmission lines. New machinery and equipment will be introduced into the landscape, including heavy goods vehicles excavators, bulldozers, and other heavy equipment. The impacts are expected to be the same as those experienced during construction.

7.3.7 Noise

Local noise levels will be affected temporarily by decommissioning activities such as equipment movement during building demolition and use of heavy machinery. The impacts will be similar to those experienced during the construction phase.

7.3.8 Socio-economic Impacts

Similar to construction, the use of a workforce and decommissioning activities could potentially generate a variety of health and safety risks to the local residents, due to general site decommissioning activities (removal of site equipment and infrastructure) and the presence of project vehicles on local risks posing a risk to local residents and school children. A Community Health and Safety Plan, Traffic Management Plan and Emergency Response Plan will be in place for the decommissioning phase of the Project.

7.3.9 Transportation and Access

Decommissioning effects are likely to be similar to that during construction although reduced in magnitude. At this stage, it is not possible to quantify the traffic effect during decommissioning of the Project as it is considered to be too far in the future to estimate any baseline traffic flows. It is unlikely however to present any significant effects.

8. Mitigation Measures

The proposed mitigation principles outlined below are deemed to be required for the Project based on the information available to date and have been developed in line with IFC Performance Standards and Guidance. All mitigation measures identified in the ESIA will be transposed into the project ESMP and will be implemented through the project ESMS. Therefore, those documents contain the final agreed mitigation measures that will be implemented during the lifetime of the Solar Project.

8.1 Air Quality

8.1.1 Construction Phase

The change in ambient air quality may arise during construction as a result of fugitive dust and particulate matter emissions. However, such impacts are expected to be temporary and of short-term nature as they are limited to the construction and decommissioning phases only.

A Dust Management Plan will be prepared to identify potential sources of dust emission and provide guidance to EPC on measures to control the generation of dust, particularly during construction.

Dust emissions can be generated directly from construction activities of the project, its ancillary facilities and associated traffic; including clearing of topsoil, transport and open storage of materials, and from unpaved roads.

If visible dust dispersion to off-site locations becomes apparent additional control measures may include a maximum speed limit in dust-prone areas, cover stockpiles, temporarily suspend activities at the source of the dust emissions until wind speed is reduced, and/or apply additional water to access roads and work areas as necessary.

Internal access roads will be constructed of a base of crushed rock topped with a layer of gravel to minimise dust.

In addition, the following mitigation will be implemented:

8.1.1.1 Vehicle movements, roads and parking area

- Dusty material should be covered during transport.
- The main vehicular access roads to the project site shall be stabilized to eliminate visible fugitive dust from vehicular travel and wind erosion.
- Construction exit-wash bays shall be provided to control sediment, dust, weed (seed), etc and not to avoid scattering of any muds in the roadway when vehicle is exiting the construction site. Wash bay shall be provided in the temporary construction compound.
- Roads will be maintained to ensure dust levels are minimised.
- Implement speed limits of 20 kmph within the site to reduce dust emissions. Traffic speed signs shall be displayed prominently at all site entrances and at egress point(s).
- Spray water on roads and dusty materials stockpiles, to increase the moisture content, a few times a day along the construction traffic route. The use of oil and oil by-products are not permitted to control road dust.
- All soil and quarry materials will be covered when being transferred to site by truck.

8.1.1.2 Site clearance

- Maintain the natural topography and vegetation where possible for soil stabilization.
- Establish parking / laydown areas and paved roads first in the construction programme where possible.
- Turn off equipment when it is not in use.
- When wind speeds exceed 10 m/s minimize new disturbance to the extent possible and/or mobilize additional water spraying to minimize dust emissions from exposed surfaces. This would be the equivalent of a 6 on the Beaufort Scale where large branches are in continuous motion and whistling sounds heard in overhead or nearby power and telephone lines.

8.1.1.3 Disturbed and uncovered surfaces

- Stabilize surfaces upon completion of grading when subsequent development is delayed; except when such a delay is due to precipitation that dampens the disturbed surface sufficiently to eliminate visible fugitive dust emissions.
- When feasible, use a water to maintain moist disturbed surfaces and actively spread water during visible dusting episodes to minimise visible fugitive dust emissions.
- Minimise disturbance areas to the maximum extent feasible.
- Stockpiles should not exceed 2.5 m in height.
- For non-road or parking area earthen surfaces, stabilize surfaces by compaction, or other means sufficient to prohibit visible fugitive dust from wind erosion.

8.1.1.4 Roads

In order to minimise dust emissions from traffic movement within the site, all traffic will be required to keep to designated access roads. All roads within the site will include a subbase and base course consisting of well graded crushed stone. Roads will be surfaced with either concrete or asphalt.

8.1.2 Operational Phase

No specific mitigation is proposed during the operational phase.

8.1.3 Decommissioning Phase

Impacts during decommissioning are expected to be similar to the construction phase. The mitigation measures proposed for construction would be implemented during decommissioning.

8.2 Archaeology

8.2.1 Construction Phase

Appropriate mitigation will be carried out in tandem with construction works. An archaeological examination was undertaken as part of the OVOS approval process and further archaeological investigation was undertaken.

The following range of archaeology and cultural heritage mitigation measures are proposed at this preliminary stage. These have been developed with reference to national legislation, IFC PS 8 and other applicable standards.

The main method of mitigation will be the implementation of the following chance finds procedure followed by specifical management measures if appropriate:

- A **Chance Find Procedure** is the key mitigation proposed and will be implemented during construction groundworks to reduce the likelihood of impacts occurring without adequate mitigation. The Developer or its contractors will not disturb any chance find further until an assessment by a competent professional is made and actions consistent with the requirements of IFC PS8 are identified.
- **Cultural Heritage Awareness Training** will be integrated into workforce site inductions and toolbox talks for all Project staff, contractors and subcontractors.

Should chance finds be recorded, the following management and mitigation will be implemented:

- **Design amendments – micrositing of design components (embedded mitigation)**. Should potentially significant archaeological remains be identified, elements of the Project may be micro-sited to avoid impacts upon them.
- **Excavation and recording**. For practical reasons, when archaeological sites cannot be preserved by altering the Project design or protected by signage/fencing, and relocation is not practicable, sites will be excavated and recorded in mitigation according to the principle of 'replacement by record'. This may involve a set-piece excavation undertaken prior to development, or a watching brief on groundworks alongside development.

- **Protection of vulnerable sites**: Vulnerable sites will be protected, if appropriate, by temporary flagging/ fencing and signage subject to the agreement of heritage authorities, ensuring an adequate buffer and staff awareness training.
- **Traffic management** including designated temporary access routes will be used to prevent soil erosion and vehicular and pedestrian damage to archaeological and cultural heritage sites.

8.2.2 Chance Finds

A review of the known archaeology and history of the wider project area indicates that there is low potential for the presence of Palaeolithic, Mesolithic and Neolithic material. Throughout the later prehistoric, antique and medieval periods, it is likely that this semi-arid desert area was populated by mobile herders. There is some potential for the presence of stray finds (casual losses), travellers' campsites and for burial mounds (kurgan).

Any terrestrial archaeological remains within the Project Area are likely to comprise:

- In situ surface scatters or features identified on bare ground.
- Surface scatters identified in areas of disturbed ground or in up-cast spoil from groundworks.
- Buried features, which may have moderate depth and complexity.

8.2.2.1 Procedure

Although there are not likely to be direct impacts on any features during construction, mitigation will focus on the implementation of appropriate archaeological chance finds procedure during initial construction works to identify any uncovered archaeological features.

The Contractor (with specialist archaeologist) during its activities will follow the following procedures:

- The person or group (identifier) who identified or exposed the archaeological sites, objects or artefacts must cease all activity in the immediate vicinity of the site.
- The identifier must immediately inform his/her supervisor of the discovery; The supervisor must then inform the Company representative at the construction site.
- Record every chance find and complete the documentation, keep an overall record that is reportable on a monthly basis. In the case of chance finds of high archaeological potential will implement the chance find procedure, the area affected by the finding will be defined and fenced off by the contractor.
- The supervisor must ensure that the site is secured and control access.
- Archaeological materials uncovered during excavations should be stored in finding boxes (with appropriate lists indicating the stratigraphic units of provenance and the general classification of the finds).
- The finds should be stored in the nearest museum or in the regional directories.
- Photographic documentation for the chance finds (if any).
- The EPC must inform the Department of Culture and request their presence to inspect the find.
- The Department of Culture will propose adequate mitigation measure for findings protection.

8.2.2.2 Stop Work Protocol

Construction work may uncover previously unidentified artefacts. This may occur for a variety of reasons. In the case of chance finds, the following stop protocol work will be used.

Upon the discovery of archaeology and cultural heritage elements EPC (with specialist archaeologist) will:

- Inform the Company that will inform, discuss and agree with Department of Culture how to proceed (stop work, remove the discovery etc.).

Where the Department of Culture requires further investigation, the EPC will:

- Report substantial archaeological finds immediately to a museum as specified by the Department of Culture, so that an investigation and evaluation of the finds can be carried out; and

Publish the results of any investigation or excavation by an archaeologist in order to bring this information into the public domain.

The EPC will address any additional reasonable requests by the Department of Culture that are not explicitly described herein.

8.2.2.3 Mitigation Strategies

In case of chance find, the Construction Manager will be promptly informed. The Construction Manager will involve the Project Manager who will be responsible to inform the Company about the chance find. The Company will advise the Department Culture which will be in charge to arrange the following actions to undertake.

The item found will not be moved or touched until the arrival and intervention of the Department of Culture.

Mitigation strategies will be implemented, if necessary, to reduce the impact on Cultural Heritage in the project area. These will involve:

- Documentation and assessment of chance finds;

Mitigation of development impacts: it includes implementing long-term protection strategy for archaeological sites to be impacted by the project (according to the ESIA there are no archaeological sites in the project area and nearby it). If protection of the site is not possible the Contractor conducts an archaeological excavation to document the site and remove the artefact.

If archaeological finds of High significance will be discovered on site and cannot be removed, the EPC, in accordance with the Company and relevant Department of Culture, will follow IFC PS8 requirements as follows:

- Company shall consider protection through preservation in place.
- If archaeological finds must be removed:
- When no technically or financially feasible alternatives existed.
- The benefits of the projects outweighed the anticipated CH loss of removal.
- Removal was by the best available technique.

Consulted with relevant national or local regulatory agencies entrusted with the protection of archaeological find and with affected communities who use, or have used within living memory, the archaeological finds, and incorporated the views of these communities into the decision-making process.

Where archaeological finds have been identified and significant damage may be unavoidable, the Company shall conduct good faith negotiations with, and documented the informed participation of affected communities and the successful outcome of negotiations.

Appropriately mitigated other impacts on critical CH with the affected communities.

If archaeological finds are kept:

- Company identified proposed project use of cultural resources, knowledge, innovations, or practices of local communities embodying traditional lifestyles for commercial purposes.

8.2.3 Operational Phase

No specific mitigation is proposed for the operational phase.

8.2.4 Decommissioning Phase

No specific mitigation is proposed for the decommissioning phase.

8.3 Biodiversity

8.3.1 Pre-Construction Surveys

Searches of potential burrows with endoscope and live capture of reptiles, including species of international and national concern (including all PBF reptile species i.e., Tajikistan Toadhead Agama) will be undertaken within the footprint of the solar farm infrastructure under the supervision of suitably experienced herpetology specialists in accordance with regional government permitting requirements[129]. Any reptiles which are found will be translocated to a reptile receptor area, as advised by the herpetologists. Successful translocation from the construction footprint and returning them to the site once construction is complete is part of the requirement to achieve No Net Loss (NNL) of species defined as PBFs and net gain of CHs. The BAP will fully detail all relevant construction mitigation measures (BAP) and habitat restoration and operation mitigation and enhancement measures which will be completed during and after the construction period to achieve the objectives of Net Gain and/or No Net Loss for PBFs, NH and CH as appropriate.

8.3.2 Site condition assessment and definition of no net loss / net gain

In line with GN43 of PS6, the Project will "design and implement mitigation measures to achieve at least no net loss of biodiversity, where feasible, through the application of on-site and offset mitigation measures". The mitigation strategy will also align with EBRD PS6, para 16, and will be described in a Biodiversity Action Plan or biodiversity action plan (BAP), wherever appropriate. It is proposed to develop a BAP for this project that will incorporate measures normally part of a BAP.

The term no net loss is defined as "the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration, and finally to offset significant residual impacts, if any, on an appropriate geographic scale (for example, local, landscape-level, national, regional)." Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. In the context of this project, Net gain would equate to an improvement of habitat quality (increased HHs) and/or an increase in population density for NH, PBFs and CHs.

No net loss and net gain includes natural habitat and its associated significant biodiversity values. Significant biodiversity values in this case include NH, PBFs and CHs.

EBRD's PR6 requires No Net Loss (NNL) of Priority Biodiversity Features (PBFs) and the habitats that support them. There is a requirement to demonstrate net gain for CHs designated due to overwintering populations of Great bustard.

The project will achieve NNL/NG by implementing the following general measures:

1. Ensuring the local population of PBFs remains stable (if not improves) at the site. For reptiles, this is accomplished by temporary re-location to a relocation area located on similar habitat adjacent to the site during construction and subsequent re-release into the larger project area post construction.
2. Restoring the habitat in the project area that supports CH or PBFs and improving its quality relative to the pre-project baseline.
3. Protecting the project area from human interventions, such as poaching, grazing, or other activities that could have a negative impact on the species and their habitat. This will be achieved by fencing the full PV area.
4. Providing passages in fencing for species to move in and out of the project site.

Performance against the NNL and NG requirement will be measured as follows.

1. The population of PBFs at the site will be measured annually using a *mark-recapture* method or as appropriate. [130]

[129] The full details of the reptile mitigation which has been undertaken in 2022 will be added to the BAP. The GBI ecological summary report is provided as Appendix E.
[130] https://en.wikipedia.org/wiki/Mark_and_recapture

2. The quality of the habitat at the site will be measured by comparison with a benchmark site considered to be high-quality tortoise habitat in the same ecosystem. This is accomplished by:

    a. Finding an area of high-quality habitat in the same ecosystem, install sampling plots (enough to allow for statistical comparison with project site), and measure the following variables: % vegetative cover; % native species; richness of native species; Pielou's evenness index of native species (J'); % herbaceous plants; % shrubs. This is the *benchmark* against which the project site will be compared. The project site does not need to attain these benchmark values – the benchmark is simply a reference point.

    b. Install sampling plots in the project area (enough to allow for statistical comparison with benchmark and post-construction samples at this same site) *prior* to construction, and measure the variables enumerated above. Compare the values for each variable relative to the benchmark site. Express the comparison as a percentage of the benchmark values.

    c. Return to the project site sampling plots every year *post* construction, and measure the variables enumerated above. Compare the values for each variable relative to the benchmark site. Express the comparison as a percentage of the benchmark values.

3. Metrics to be determined, that demonstrate the presence of protective infrastructure (e.g., adequate fencing) and enforcement monitoring.

4. Documented presence, maintenance, and use of passages in fencing by tortoises.

Monitoring will be undertaken for the first three years of operation, at which point the success of the BAP will be reviewed and a decision taken to either extend monitoring or to confirm that NNL/NG has been achieved and that monitoring can be discontinued.

NNL and NG will be achieved when:

1. The population of PBFs is the same or better than pre-construction baseline.

2. The post-construction project site has equal or better habitat scores (measured as a % of the benchmark) as the pre-construction project site (baseline).

The BAP will be prepared and will include for the repeat surveying of the Project area to confirm the findings of the ESIA and monitor restoration.

The following metrics will be used to identify NNL and NG.

8.3.2.1 Habitat Metrics

As noted in the construction earthworks activities, the following areas will be cleared during the initial earthworks.

Table 50. Earthworks

Parameter	Area
Length of fence (m)	17,080
Area or roads (m2)	To be confirmed
Area of substation (m2)	48,000
Area of inverter bases and any other infrastructure or hardstandings (m^2)	1,200
Area of laydown area (m^2)	24,200
Area shaded by PV panel (m^2)	2,286,095
Area of land left free of panels (m^2)	3,903,905
Land Boundary Area (m2)	6,31,000

Source: Masdar

Based on the initial site design, a total of 7.34 ha land would be permanently cleared or 1.15% of the overall site area. It is reasonable to assume up to 3% could be cleared, including internal roads. As a result, a restoration target will be set to improve the remaining areas free of panels to achieve NNL and NG as appropriate. It is deemed that there are significant areas on the PV site to allow habitat restoration to take place.

8.3.2.2 Indicator Species Metrics

The project will measure on an annual basis the population density of PBFs and compare against the pre-construction population estimates. NNL and NG will be achieved when the population density is equal to or exceeds that recorded pre-construction.

8.3.2.3 Infrastructure Metrics

NNS has included measures to avoid habitat fragmentation (GN46) and this will focus on the inclusion of tortoise gates in the site fencing to allow free movement back and forth. Furthermore, the site will be fenced to prevent grazing and hunting. The following metrics will be measured:

- Site fully fenced to exclude grazing and hunting.
- Gates on perimeter fence at a distance of 1 gate per 100m of fence

8.3.3 Construction Phase

8.3.3.1 Impacts on terrestrial ecology (PBF species) during construction

- Prior to undertaking any works on site, the EPC contractor/Ecologist shall clearly delineate the approved clearing and disturbance footprint using temporary fencing, flagging tape, para-webbing or similar.
- Pre-clearing surveys will be carried out by the ecology team prior to topsoil stripping or other works starting in the pre-construction area. The Ecologist will identify burrows that appear suitable for hibernating Central Asian tortoise and will carry out searches with endoscope to confirm presence of hibernating tortoises. If found within the hibernation period, burrows will be marked and fenced to ensure that works will be excluded from the area until they can be moved between March and July.
- The Ecologist will undertake an assessment to establish a suitable receptor area adjacent to the northern boundary of the project site, in close proximity to the operational footprint of the northern boundary fence (to overlap with typical movement within a home range for this species, as advised by the Ecologist). The precise location of the receptor area will be agreed with the Ecologist and the regional Goscomecology representative. The exact release date will be determined by temperature, weather conditions and suitability of habitat. Animals will be marked and numbered to allow ongoing monitoring.
- The EPC/Ecologist should provide awareness training during site induction and toolbox talks with an emphasis on the sensitivities relating to PBF and CH species in particular and the specific Project requirements. The awareness will focus on identifying the species, preferred habitat and what to do in the event of a chance find. This will require the ecologist on-site to be informed. They will assume control of the situation and will physically move the reptile to a safe location away from construction vehicles. The ecologist will determine the most suitable location.
- Project vehicles will be restricted to designated construction roadways and designated parking areas.
- Where construction is continuing from March onwards, wooden planks or similar will be placed in excavations to allow tortoises or other animals to escape should they fall into the excavation. Excavations will be checked at the start of each shift and if an animal is identified, the EPC/Ecologist will be notified and will remove the animal to a safe location.

8.3.3.2 Minimise loss/damage of existing habitat during construction

- No work will take place on areas identified as Habitat Management Areas on the PV site. This area will be demarcated to ensure vehicles and workers do not enter the area. Currently the full site is assessed as MH.
- EPC and subcontractors adhere to the IFC Good Practice Note: Managing Contractors' Environmental and Social Performance.

  - Project staff and contractor(s) shall compile and implement a faunal protection policy to avoid unnecessary killing of fauna, ensures speed limits are controlled, hunting and possession of hunting equipment is prohibited, and taking pets and/or purchase/sale of wild animals or animal products is prohibited.
  - Project staff and contractors require environmental toolbox talks during construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna.
  - Staff will be briefed on risks of exposure to scorpions, spiders and snakes as well as the preventative measures. Workers in the field will wear protective clothing, long trousers, closed shoes and leather gloves. Information regarding nearest location of treatment for any bites and stings will be made available.
  - Any snakes encountered at the site must not be handled or harmed by Project workers. Animals must be relocated by appointed personnel.
  - Construction vehicles must remain on the access roads and not drive over vegetation which is not subject to site clearance.
- Prior to undertaking any works on site, the EPC contractor/Ecologist shall clearly delineate the approved clearing and disturbance footprint using temporary fencing, flagging tape, para-webbing or similar.
- Habitat Improvement Areas shall be clearly delineated using temporary fencing, flagging tape, para-webbing or similar. These areas will be used to offset loss of habitats on site.
- The EPC/Ecologist should provide awareness training during site induction and toolbox talks.
- The EPC shall disturb only the areas necessary for construction. This is the best way to limit the amount of erosion control that is required throughout the project.
- The EPC shall keep natural vegetation in place and leave topsoil undisturbed wherever possible during the main construction phase (e.g. piling works).
- Geotextile membranes will be used to avoid damage to natural habitat during the main construction phase (e.g. piling works).
- Project shall be developed in phases to minimise vegetation disturbance and control erosion. The EPC shall not break new ground until absolutely necessary. This will limit the amount of erosion during each construction phase and will help to conserve the natural seed bank contained within the topsoil.
- Project vehicles will be restricted to designated construction roadways and designated parking areas.
- The EPC shall manage stockpiles and exposed ground to minimise dust and erosion. Stockpiles shall be a maximum height of 2m.
- The EPC shall locate stockpiles at least 50 m away from watercourses, ditches and drains.
- The EPC shall locate stockpiles on areas of Modified Habitat.
- All waste shall be stored within the designated storage area.

8.3.3.3 Habitat Restoration and Rehabilitation Measures

Habitat restoration to achieve No Net Loss of PBFs, based on guidance provided by the appointed specialist team of herpetologists. Habitat restoration will be applied within the PV site. Further detail will be provided in the BAP.

8.3.3.4 Minimise loss/damage of topsoil (and associated seedbank)

- Soil storage areas should be located on modified (historically cultivated land) within the project area.
- Excavated soils will be stored separately in accordance with their stratigraphic layers.
- Topsoil will be stripped to a maximum depth of 30 cm and stored separately in clearly demarcated areas. These areas will be recorded via spatial mapping.
- Subsoil will be stored separately and again will be recorded via spatial mapping.

- Stockpiles do not exceed 2 m in height.
- Areas of excavated soil and stockpiles shall be compacted to minimise erosion. There is a presumption against spraying with water as it may stimulate germination and hinder future restoration.
- Remove all alien or invasive species from the site area if encountered. Removal shall be manually in the first instance.
- Project staff require environmental toolbox talks during construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna.
- Searches for other reptiles (will be undertaken above ground or using an endoscope to search likely burrows during the construction phase within the footprint of the solar farm infrastructure (e.g. location of piles) under the supervision of a suitably experienced ecologist/herpetologist. If tortoises are found they will be removed to the designated tortoise mitigation area, as advised by the ecologist/herpetologist. Translocation from the construction footprint is a requirement to achieve No Net Loss (NNL) of reptile species defined as PBF's. Further detail will be provided in a Biodiversity Action Plan.
- During routine maintenance any invasive flora species will be removed.
- Ground stabilisation and revegetation shall be undertaken once work is complete in a given area.

8.3.3.5 Storage of Excavated Soil

- Soil that is excavated should not be stored in areas of ecological importance. The designated storage area may need to be checked for reptiles and breeding birds by the appointed ecological specialists.

8.3.3.6 Zoning of Ecological Sensitive Areas

- It may be necessary to establish temporary exclusion zones within the main working area, as advised by the appointed ecological specialist. These ecological sensitive areas may need to be protected due to season constraints, such as the presence of a rubble pile that could be used by hibernating reptiles; or an active bird nest. Barrier fencing mesh is considered suffice for this purpose and zone should be signed 'Ecological Sensitive Area'.
- No excavations will be left uncovered as this presents a risk of reptiles and small mammals becoming unnecessarily trapped. If trenches and pits are exposed over-night then escape routes for fauna must be made at regular intervals.

8.3.3.7 Bird deflectors

- The key operational mitigation measures for the transmission line relates to the mitigation of avian collision. Bird deflectors will be installed along the entire length of the Overhead Line between the Solar PV and the existing sub-station at Saribazar; one diverter (Firefly or equivalent type to be agreed with Lenders) every 10m and staggered placement of them on the different lines to provide maximum coverage (refer to Ferrer et al, 2020)[131].
- The final mitigation design will be discussed with Birdlife International, IUCN SSC Bustard Specialist Group, Eurasian Bustard Alliance and UzSPB who will be provided the opportunity to provide input into the most suitable design. An initial introductory call with BirdLife International took place on 21 December 2022.

8.3.4 Operational Phase

Operational mitigation measures for the Solar PV site are detailed below:

- No work will take place on areas identified as Habitat Management Areas on the PV site. This area will be demarcated to ensure vehicles and workers do not enter the area. The only Project access will be the ecology team who will monitor the level of improvement of the habitat to monitor the effectiveness of the BAP.

[131] Ferrer *et al* (2020), *Efficacy of different types of "bird flight diverter" in reducing bird mortality due to collision with transmission power lines*. Global Ecology and Conservation, Vo. 23, September 2020, e01130.
Found at: https://www.sciencedirect.com/science/article/pii/S2351989420306715

- During routine maintenance any invasive flora species will be removed.
- Natural revegetation of the cleared areas will take place. The success will be monitored and if necessary additional measures will be undertaken such as watering of those areas.
- All cleared areas will be infilled to avoid the risk of reptiles and small mammals becoming unnecessarily trapped.
- Following completion of construction works and in order to allow the free movement of reptiles and small mammals in/out of the site, a series of holes (minimum of 12cm height/breadth) will be dug under the base of the fencing . Further detail will be provided in a Biodiversity Action Plan.
- Internationally and nationally protected fauna and flora will be subject to post-construction monitoring . Further details will be provided in a Biodiversity Action Plan.

The key operational mitigation measures for the transmission line relates to the mitigation of avian collision, as follows:

Bird deflectors will be installed along the entire length of the Overhead Line between the Solar PV and the existing sub-station; one diverter (Firefly or equivalent type to be agreed with Lenders) every 10m and staggered placement of them on the different lines to provide maximum coverage (refer to Ferrer et al, 2020)[132]. As noted, the final design will be discussed with the Great bustard working group who will provide input into the most suitable design. During operation the project will monitor the condition of the deflectors and if necessary replace any that are broken or deficient.

Collision monitoring will be undertaken along the OHTL.

All mitigation and monitoring will be included in a Biodiversity Action Plan which will also need to include a robust Adaptive Management Strategy should the results of monitoring indicate an impact on Great Bustard or other species of global conservation concern (e.g. Sociable Lapwing or raptors). The BAP will include an outline Off-setting Plan (as described above) which will need to be developed and in place should the results of the monitoring indicate an impact on bird species of global or national conservation concern

Further details will be provided in a Biodiversity Action Plan.

The BAP will validate the accuracy of predicted impacts and risks to biodiversity values posed by the Project, and the predicted effectiveness of biodiversity management actions and should include the following:

- Baseline: measures of the status of biodiversity values prior to the Project's impacts
- Process: monitoring of the implementation of mitigation measures and management controls
- Outcomes: monitoring of the status of biodiversity values during the life of the project, compared to the baseline.

The BAP should include a practical set of indicators (metrics) for the biodiversity values requiring mitigation and management. Specific thresholds (e.g. KPIs) should be set for monitoring results that will trigger a need to adapt the management plan(s) to address any deficiencies in performance.

Monitoring of populations of CH and PBF species known to be present on site will be undertaken to ensure that there are no long-term negative impacts as a result of the Project. On-going monitoring and reporting will be completed throughout the construction and operation phases of the Project in accordance with the relevant monitoring plans.

[132] Ferrer *et al* (2020), ***Efficacy of different types of "bird flight diverter" in reducing bird mortality due to collision with transmission power lines***. Global Ecology and Conservation, Vo. 23, September 2020, e01130.
Found at: https://www.sciencedirect.com/science/article/pii/S2351989420306715

8.4 Geology and Soils

8.4.1 Site Preparation

To reduce the potential for erosion of drainage channels during road construction, routes will be selected to avoid ephemeral drainage channels where possible. Culverts or other drainage control features will be installed where crossings of drainage routes are unavoidable. Stormwater run-off onto roads and uncontrolled flow from roads will be minimized.

8.4.2 Construction Phase

The risk of contamination through temporary storage facilities will be reduced through the storage of all materials within designated areas. Supplies will also be provided for the clean-up of minor spills. A Pollution Prevention Plan will be prepared to prevent accidental spillage of fuels, chemicals or other substances.

To reduce the risk of soil and water pollution from leaks and spills through storage of oil the following will be implemented:

- A designated storage area is established with an impervious base and impermeable bund walls. Capacity must be sufficient to contain 110% of the full volume within a bund and secured area.
- All fuel, oil and chemical storage is stored in a designated secure area.
- Hoses and valves are checked regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Diesel pumps and similar items are placed on drip trays to collect minor spillages. Trays will be checked regularly and accumulated oil removed.

With regards to potential impacts associated with the construction workforce, it is proposed that sanitary waste is collected in containers below portable toilets and transported for disposal. Wastewater will be disposed of at a suitably licensed facility.

8.4.3 Operational Phase

The potential for soils and groundwater contamination associated with waste disposal will be reduced through the reduction of wastes to the extent possible whilst maximising the re-use and recycling of materials. All waste and rubbish will be collected and stored before disposal at a suitably licensed facility

Mitigation measures associated with maintenance and use of oils and other chemicals include:

- Establish a designated storage area with an impervious base and impermeable bund walls and protected from precipitation. Capacity must be sufficient to contain 110% of the full volume within a bund and secured area.
- Store all fuel, oil and chemical storage in the designated secure area.
- Do not leave vehicle unattended during refuelling, never leave open a delivery valve.
- Check hoses and valves regularly for signs of wear and ensure that they are turned off and securely locked when not in use.

Place diesel pumps and similar on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil.

8.5 Hydrology and Hydrogeology

8.5.1 Site Preparation

To reduce the potential for erosion of drainage channels during road construction, routes will be selected to avoid ephemeral drainage channels where possible. Culverts or other drainage control features will be installed where crossings of drainage routes are unavoidable. Stormwater run-off onto roads and uncontrolled flow from roads will be minimized.

8.5.2 Construction Phase

The risk of contamination through temporary storage facilities will be reduced through the storage of all materials within designated areas. Supplies will also be provided for the clean-up of minor spills. A Water Management Plan will be prepared to prevent accidental spillage of fuels, chemicals or other substances.

To reduce the risk of soil and water pollution from leaks and spills through storage of oil the following will be implemented:

- A designated storage area is established with an impervious base and impermeable bund walls. Capacity must be sufficient to contain 110% of the full volume within a bund and secured area.
- All fuel, oil and chemical storage is stored in a designated secure area.
- Hoses and valves are checked regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Diesel pumps and similar items are placed on drip trays to collect minor spillages. Trays will be checked regularly and accumulated oil removed.

With regards to potential impacts associated with the construction workforce, it is proposed that sanitary waste is collected in containers below portable toilets and transported for disposal. The waste will be disposed at a location to be agreed with Local Government respective officer or environmental officer.

8.5.2.1 Utilities

The source of water for the project has not yet been confirmed. At this stage it is proposed that the project purchase water direct from a suitably licensed utility company, which will be delivered by tanker.

The EPC Contractor will investigate the potential to segregate and reuse grey water on-site where practical.

8.5.2.2 Discharge of Surface Water

Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality.

During construction, there will be no pre-planned direct discharges to areas potentially holding surface water, including ephemeral streams. No pathways have been identified where releases to effluent systems could be made. However, construction activities have the potential to pollute through accidents from the escape of:

- Silty and contaminated water from de-watering of excavations, exposed ground, earth stockpiles, and muddy roads.
- Leakage or accidental spillage of fuels, oils, chemicals etc., especially on the construction lay-down area.
- Washing down concrete mixing and delivery equipment.
- Sanitary wastewater from the welfare facilities.

This is detailed in the Water Management Plan (REF 09) and Hazardous Material and Waste Management Plan (REF 08).

8.5.2.3 General Mitigation

To prevent impacts from runoff during land preparation and construction the EPC shall carry out the following measures:

- Construction debris will be stored in proper designated areas and at least 50m from seasonal surface water courses.
- Refuelling shall not be permitted within 50m of the seasonal water courses.
- Fuel shall be stored in suitably bunded areas, containing at least 110% of the total volume stored and at least 50m from seasonal surface water courses.

- Site office, temporary facility, worker accommodation and other similar site infrastructure shall not be permitted within 50m of the seasonal water courses.

To reduce the risk of potentially polluting materials such as oils, fuels and chemicals leaking, use dedicated storage areas with secondary containment and spillage protection and working procedures, which ensure that these materials are handled correctly. Waste oil and grease from the construction site shall be collected in suitable drums and transported out for proper disposal. Records of disposal of such material will be kept.

This will be detailed in the Waste and Wastewater Management Plans respectively.

8.5.2.4 Tracks

Tracks within the site will have a 2% camber allowing surface water to run off into adjacent compacted soil ditches. If necessary, soil ditches will collect rainfall and channel it to the lowest point of the site on the southern boundary. Surface water will then be allowed to discharge to land. It is not currently proposed to develop a surface water drainage system.

8.5.2.5 Wastewater

Waste oil and grease from the construction site shall be collected in suitable drums and transported for proper disposal. Records of disposal of such material will be kept. The location of suitable waste disposal facilities has yet to be confirmed.

8.5.2.6 Grey Water

The EPC will investigate the feasibility of collecting greywater from laundry, kitchen, offices and washroom/showers. Grey water would be piped to a central storage tank. The water can then be used for irrigation to aid restoration and for dust control if required. Should grey water be used it will be analysed in an approved laboratory to determine suitability for specific uses.

8.5.3 Operational Phase

The potential for soils and groundwater contamination associated with waste disposal will be reduced through the reduction of wastes to the extent possible whilst maximising the re-use and recycling of materials. All waste and rubbish will be collected and stored before disposal in at a suitably licensed site.

Mitigation measures associated with maintenance and use of oils and other chemicals include:

- Establish a designated storage area with an impervious base and impermeable bund walls and protected from precipitation. Capacity must be sufficient to contain 110% of the full volume within a bund and secured area.
- Store all fuel, oil and chemical storage in the designated secure area.
- Do not leave vehicle unattended during refuelling, never leave open a delivery valve.
- Check hoses and valves regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Place diesel pumps and similar on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil.

8.6 Landscape and Visual

8.6.1 Design Phase

Landscape and visual mitigation for the Project was embedded in the design of the solar farm to centre around the selection of a layout which minimise the potential for significant impacts whilst achieving operational objectives.

8.6.2 Construction Phase

The best form of mitigation for landscape and visual impacts arising from construction is related to conservation of soils and vegetation.

Mitigation to reduce the adverse impact resulting from litter and rubbish (plastic bags, bottles etc.) include:

- Floodlights will be positioned and directed so as not to point outside of the site.
- Provision of adequate facilities for the disposal of rubbish.
- Training of the workforce in waste management.
- Reduce the amount of waste to the maximum extent possible.
- Collect all solid waste and store until transported to an appropriate waste disposal facility and disposed.
- Organization of clean-ups for existing rubbish.

8.6.3 Operational Phase

Vegetation around the Project that does not affect the performance of the Solar Park will be left in place or rehabilitated.

8.7 Noise

8.7.1 Construction Phase

In order to reduce the impact of noise during construction, best practicable means will be followed to ensure that the quietest available plant and construction techniques will be used in order to limit noise output as far as practically possible. The initial noise assessment has concentrated on the closest settlement to the south. It is deemed that the villages are of sufficient distance from the site to ensure that construction impacts are not likely to be significant. AECOM anticipate that the highest magnitude noise impacts will be experienced during piling operations.

Construction will generally be undertaken during normal working hours although some works may be required outside of this time. Where appropriate, micro siting will be undertaken to ensure construction noise impacts are minimised and equipment is located as far as possible from Noise Sensitive Receptors (NSRs). Mitigation measures will also include the use of a sufficient buffer between the Project and local properties to reduce noise to an acceptable level at those locations.

In addition, Project construction traffic routing through community areas will be minimised wherever possible.

A Noise Management Plan will be developer to identify the quietest available plant and construction techniques to be used to limit noise output during construction works. These include:

- Restrict all construction activities to daytime during normal working hours (0700 am – 1800 pm).
- Where appropriate, micro-siting is to be undertaken to ensure construction noise impacts are minimised and equipment is located as far as possible from noise sensitive receptors (NSRs). NSRs include onsite accommodation.
- Routing of project construction traffic shall be through the main highway and short section of unmarked road to site. Refer to the Transport MP for further details.
- Adopt and follow best practicable means to ensure that the quietest available plant and construction techniques are used. Such as:
  - Selecting equipment with lower sound power levels
  - Installing silencers for fans
  - Installing suitable mufflers on engine exhausts and compressor components ·
  - Installing acoustic enclosures for equipment casing radiating noise
- Provide prior information to the community of any planned noisy activity that is likely to exceed the permitted noise levels (piling work)

- Strictly ensure the use of protective personal equipment at all times while on site and noise reduction techniques such as silencers and ear mufflers to employees
- Machinery and equipment shall be maintained in good conditions in order to minimize noise.
- In the event of a valid grievance being received, carry out an investigation of noise levels to determine whether they comply with permitted maximum levels, including all vehicles and machineries on site. For this task, a handheld noise monitor will be used to measure IEC A-weighting ($dB(A)_{eq}$).

8.7.2 Operational Phase

The initial noise assessment has concentrated on the village on the southern boundary but it is deemed to be of sufficient distance from the site to ensure operational impacts are not likely to be significant.

Should additional mitigation be required during the operational phase, the following will be considered if required following detailed noise assessment:

- Installation of acoustic enclosures for equipment causing radiating noise (this would typically give 3 dB attenuation).
- Improving the acoustic performance of constructed buildings, through employing sound insulation.
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the barrier. Barriers will be located as close to the source or to the receptor location to be effective. It is noted that the earth bund adjacent to the canal will provide a degree of noise attenuation.
- Installing vibration isolation for mechanical equipment.

In addition, the Community Grievance Mechanism developed under IFC PS 1 will be implemented during both the construction and operational Project phases. This will be utilised to record, monitor and respond to / mitigate any noise related impacts raised by the local community and ensure compliance with noise limits is achieved at NSRs.

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8.8 Social Mitigation and Enhancement

The following sections provide indicative measures to mitigate the negative effects and enhance the positive effects of the Project according to the impacts listed in Section 7. The systematic approach for mitigation development will consider policy and procedure instruments, training and capacity building, and economic investment. The mitigation and monitoring measures identified within this section will be further developed within the Project's ESMP and associated sub-plans.

8.8.1 Construction Phase

8.8.1.1 Community Expectations of the Project

Communicate employment estimates, timeframes and skills requirements clearly to the community on a continuous basis.

Develop and disclose a Local Recruitment and Employment Plan in consultation with the community and in a way that meets long term operational needs of the Project as well as the short-term construction needs, taking into account the relatively low skill base of the local population when it comes to solar power related jobs. This Plan will outline the recruitment strategy and processes, including the promotion of equal opportunities. It will be developed on the basis of a social survey and will include a clear local content target, advertising of local job position will be made available in a central location and information will be available in the local language. The Plan will also describe how women and Project Affected People will be given priority, alongside with residents of local communities for recruitment and training before the start of construction activities (also included in the following section). Stakeholder Engagement Plan to be developed and implemented.

8.8.1.2 Increased local employment, capacity building and supply demand

To enhance the direct and indirect economic opportunities during the Project construction a Local Hiring Plan will be developed and implemented. The objective of the Plan will be to develop a workforce, preferably, of a combination of nationals and expatriate workers that meets long term operational needs of the Project as well as the short-term construction needs, taking into account the relatively low skill base of the local population when it comes to solar power related jobs. This Plan will consider the following activities:

- Investigation of local sourcing and procurement opportunities to promote sustainable small business and local training schools' partnerships that comply with the standards of the Project development.
- Investment in capacity building for small businesses to enable them to meet standards for procurement required by the company and to service the needs of influx populations and indirect employees (through service industries). This will be designed with a participatory and inclusive strategy between key stakeholders for economic development and the local people.
- Identification and monitoring procedures for compliment with IFC PS2 and ILO standards.
- Communication of job openings in the commonly used media identified in previous consultations through the Stakeholder Engagement Plan.
- Development of a transparent recruitment process, according to IFC PS2, which clearly communicate labour benefits (e.g. Health insurance), salary and contract length. The Plan will also describe how women and Project Affected People will be given priority, alongside local residents, for recruitment and training before the start of construction activities.
- Communication with local vocational training schools to develop curricula which will qualify local students to meet the project needs in further phases of the project and the solar industry locally, if possible.

8.8.1.3 Capacity strain contribution to local public services and facilities

A Worker Accommodation Plan is developed for the workforce. The Plan will identify the proper necessities of infrastructure, health and safety policies, and a clear strategy for the peak employee demand. Given the current assessment, the accommodation could be developed in Navoi and surrounding towns and villages, but further evaluation might be developed. If a local accommodation is selected, the Plan must consider a clear communication with stakeholders about on Project schedule and necessities of accommodation according to PS2 and PS4.

An Occupational Health and Safety Plan and a Community Health and Safety Plan will be developed to ensure that all Contractors are provided with adequate health care (for work related injuries and off the job-related health issues) that is independent of the local health care system.

The Plans related to capacity strain will be communicated to key stakeholders, in order to promote transparency and avoid conflict related to community concerns or investment expectations. The information provided will be appropriate to demographic and cultural characteristics of the AoI.

8.8.1.4 Economic Displacement

The Project will develop a Livelihood Restoration Plan (LRP) that considers any potential economic displacement that will be created by the Project including the OHTL and any consequent temporary land restriction. The LRP will be drafted in line with national regulations and international best practices and it will respond to the following objectives:

- Define national and international requirements for economic displacement
- Outline procedures for the land acquisition and compensation to be carried out by State parties.
- Identify PAPs and understand the socio-economic characteristics of affected households.
- Evaluate and assess the socio-economic activities that are located within the Project Site.
- Define appropriate levels and means of compensation for losses resulting from the Project in line with National Law and ADB standards.

- Identify other assistance and measures to enable affected households to restore and improve their livelihood.
- Define roles and responsibilities of key parties in the Project.
- Propose an appropriate grievance resolution mechanism.
- Evaluate and address disclosure and consultation requirements required by the project lenders.

8.8.1.5 Loss of public access and reduced mobility through local paths

The Stakeholder Engagement Plan will provide detailed and regular information to local community members about Project activity to mitigate community concerns about mobilisation and inform updates on access routes around the Project site. Based on the site visits and consultations undertaken, no important local paths were identified across the site and no users were observed. The access road to the cemetery and linking the north and south of the site will be maintained throughout the Project lifetime.

A Traffic Management Plan (TMP) will be developed considering the alternative access to local paths mentioned above.

8.8.1.6 Reduced access to grazing and pastoral land

The Stakeholder Engagement Plan will be the means for providing detailed and regular information to local community members about Project activity. The Solar PV site is not deemed to be an important area for grazing. Soil and vegetation is poor quality.

From AECOM's discussion with the regional agricultural department, the Makhallas , the cadaster who knows the site well and the informal farmer on the site, the herders tend to use the area of land outside of the site to the north and only use the site itself on occasion if there is enough vegetation in spring. All people interviewed said the land is of such poor quality due to lack of irrigation that herders don't use it much.

A livelihood Restoration Plan has been undertaken to quantify and mitigate potential impacts on livelihoods mainly on the transmission line.

8.8.1.7 Increased presence of workers and interaction with local communities

The Community Health and Safety Plan will be developed as a mitigation measure for unplanned worker migration and the presence of workers in the Project area. It will encompass:

- An induction for workers, that provides awareness training on communicable disease prevention (Covid-19), focusing on unplanned interaction with nearby community members.
- Ensure health screening is being conducted for employees and contractors before contracting workers and on a periodic basis throughout their employment/contract.
- Identify opportunities to support local public health campaigns that focus on prevention of communicable diseases.
- Enforce and monitor a zero-alcohol tolerance policy, including current intoxication, for workers during working hours and perform random alcohol testing through periodical screen before and / or after leaving the site. Include this policy on contractors' agreements.
- Training on the Project's goals to establish good relationships with local stakeholders, avoid unnecessary conflict with any inhabitant by respecting human rights and being acknowledgeable of culture differences.

To reduce adverse effects of influx the Project will develop an Influx Management Plan. This Plan must include, at a minimum, the following:

- Preference for hiring of people who are already established residents of local communities. Apply a mechanism to verify where job applicants come from (e.g. checking ID cards) so that jobs prioritised for members of local communities are not given to in-migrants;
- Prohibition of at-gate hiring to reduce the number of people waiting at and around the Project site;

- Working with local government in in-migration hot spots and building their capacity in dealing with impacts;
- Reviewing the range of management plans which will deal with in-migration impacts and ensuring each Project department is putting in place the required measures;
- Monitor in-migration impacts with local government and continue to provide capacity building support and report on findings;
- Suggestions on education campaigns and capacity-building training to the PACs on the dangers of alcoholism, drug abuse, domestic violence, prostitution and safe sex; and
- Ongoing engagement with the local communities to identify and respond to any grievances related to influx.

8.8.1.8 Increased presence of security personnel

The Security Management Plan will make sure that security personnel or contractor personnel are trained on the Project's goals to establish good relationships with local stakeholders, according to IFC PS4. These training will seek to avoid unnecessary conflict with any local person and establish the operational area of the security personnel solely within the Project site boundary. The Plan will include actions leading to the full implementation of the Voluntary Principles on Security and Human Rights, UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials, the UN Code of Conduct for Law Enforcement Officials and the International Code of Conduct on Private Security Providers.

The Plan will consider a procedure to log all security incidents, which will be investigated, and any security grievances will be identified and actioned.

8.8.1.9 Occupational health and safety impacts and impacts to Project workforce

The Project Developer and its contractors will comply with international Occupational Health & Safety regulations and standards in addition to Uzbek safety standards regarding construction works, electrical works, structural climbing and other hazards. In general, construction operations will be planned and implemented in accordance with these standards and with IFC safety guidelines[133]. Furthermore, the EPC Contractor will be required to demonstrate and implement a suitable management system which confirms to the standards equivalent to ISO 9001, ISO 14001 and OSHAS 18001. This will be a key contractual requirement and will be monitored by the Developer.

The Project will develop appropriate policies on labour and working conditions that will:

- Promote the fair treatment, non-discrimination, and equal opportunity of workers.
- Establish, maintain, and improve the worker-management relationship.
- Promote compliance with national employment and labor laws.
- Protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- Promote safe and healthy working conditions, and the health of workers.
- Avoid the use of forced labor and child labor.

Both the Developer shall commission an independent Labour Assessment undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors.

Furthermore, the Developer and all its contractors will be required to produce an Operation Health and Safety Plan and a Community Health and Safety Plan for both construction and operational phases and will bring together the mitigation requirements discussed in preceding sections. The Community Health and Safety Plan will describe the potential hazards of the Project during construction, commissioning and operation to local communities and how these will be controlled. The document will set out community health and safety mitigation measures and the use of land surrounding the site for

[133] IFC (2007a)

agricultural / grazing purposes. The document will also outline emergency preparedness and response along with a grievance mechanism to ensure that feedback is acknowledged and addressed appropriately.

The OHS Plan will include specific measures to prevent and mitigate Covid-19, including: induction for workers, that provide awareness training on communicable disease prevention, and OMS precaution recommendations on COVID -19.

Training on an ongoing basis on communicable disease and hygiene equipment, the correct use of Personal Protective Equipment, and in policies and procedures on health, safety and environment (e.g. aerial work, electrical safety, excavation safety, social distancing measures).

Health screening on a periodic basis for employees and / or it will describe the parameters that contractors will comply on health monitoring to avoid the spread of communicable diseases and / or COVID-19.

In addition, the Developer and all its contractors will be required to stablish Safety Policies and Procedures for construction phase. The following policies and procedures are listed as examples for the Project development:

- Develop an Emergency Response Plan (ERP) - this plan will be developed in conjunction with the Occupational Health and Safety Plan and Community Health and Safety Plan. This might state the procedures for engaging local emergency responders to at minimum: (i) communicate ERP; (ii) depending on level of risk from emergency events build local capacity to ensure appropriate local response in case of emergency.
- Safety Reporting including incident occurrences.
- Stop Work Policy
- Supplementary to both Plans, and the Safety Policies and Procedures, the Developer will identify opportunities to support local public health campaigns that focus on prevention of diseases.

8.8.1.10 Increased levels of gender-based violence, sexual exploitation and harassment

The Worker Code of Conduct shall:

- Direct Project Workers on appropriate behaviours to help avoid negative interactions with local communities and promote a positive working environment.
- Prohibit violence, discrimination, sexual exploitation, harassment, bullying, and promote equal opportunity;
- Require all project staff to adhere to safety measures;
- Prohibit working under the influence of alcohol and prohibited drugs;
- Prohibit intimidation, offensive language and behaviour, prostitution, or sexual harassment when carrying out project activities (e.g. driving project vehicles), working on Project sites or in local communities.
- Detail a mechanism for safe reporting of violations of these prohibitions and ensure investigation of any reported incidents.
- Ensure serious actions are taken up to and including dismissal of the worker and referral of cases to the local police when there is evidence of criminal acts.

The Worker Code of Conduct will be provided to all Project workers before they sign their contract of employment, and the contract of employment must state that the project Worker agrees to abide by the Worker Code of Conduct.

Training on the Worker Code of Conduct will be provided to all members of staff irrespective of their seniority or department, emphasising the prohibition on violence between Project workers, as well as provide education about how their behaviours could contribute to different types of domestic violence and harassment, including GBVSEH and economic and social violence. This programme will be designed to be culturally appropriate for the audience, and will be delivered initially through the induction programme as well as through toolbox talk topics, work place posters and presentations.

8.8.2 Operation Phase

8.8.2.1 Community expectations of the Project

The need for local labour will vary throughout the Project duration, which could raise expectations of economic opportunities above actual Project workforce demand. As a result, the Stakeholder Engagement Plan will consider an inclusive communication program that will emphasizes accurate employment estimates, timeframes and skills requirements with a clear local content target. This Plan includes a description of the responsibilities of Project staff and an organization chart related to the engagement activities. It will outline the recruitment strategy and processes to promote transparency and participation of the local population, including women.

8.8.2.2 Increased local employment, capacity building and supply demand

There will be approximately 24 workers employed during operation and the impact is not of a level that requires any specific mitigation or enhancement measures. However, the Project is in a leading position to develop skills through vocational training and other activities throughout the lifetime of the Project, particularly of residents within the Project AOI, leading to enhanced level of education, competency, and greater ability of the skilled workforce. Additionally, skills and vocational development will give local staff greater ability to find similar work in the future after their involvement in the Project is complete, increasing social mobility. Increased presence of security personnel

Results from the Security Management Plan will be evaluated by the Developer and, if applicable, by local people. The assessment results will consider recommendations to improve relationships with local stakeholders, and best practices on human rights and cultural sensitivity training.

8.8.2.3 Occupational health and safety impacts and impacts to Project workforce

See Section 8.6.1.8

Further to social mitigation and enhancement measures developed in both phases, a grievance mechanism will be developed and implemented under IFC PS 1. This will provide a communication platform to identify, address, and monitor communities' concerns on the social impacts considered in this ESIA.

8.8.2.4 Increased levels of gender-based violence, sexual exploitation and harassment

Continued implementation of mitigation measures introduced during the construction phase.

8.9 Transportation and Access

It is recommended that the efficiency of deliveries of construction materials to the site is closely monitored and, if necessary, sufficient storage provision is made available on site to prevent any delays to the construction process.

A Traffic Management Plan (TMP) will be developed which will reduce risks to drivers and components being transported. This will include (amongst others):

- Detailed site access route.
- Speed controls (such as speed limits, signs, speed bumps etc.).
- Measures for ensuring use of well-maintained vehicles which are serviced regularly.
- Measures to maintain / make good the access roads.
- Details of the temporary site compound which will include parking for up to 40 light vehicles including HGV manoeuvring, holding and unloading areas.
- Information regarding road safety briefings which will be given to all staff and contractors.
- Procedures for ensuring appropriate licenses / permits are in place for all drivers and provision of suitable training to reduce potential accidents on route to, and within, the site.
- Measures to control the delivery / departure of all HGVs to avoid conflict with other road users.
- Detail sensitive receptors en-route and ensure all drivers are aware of these.

- It is recommended that the route for use by HGVs is verified through further assessment (including a route inspection undertaken prior to construction). Consultation with the relevant Roads Authority is recommended to further identify the most appropriate route and any permits or additional mitigation measures required.

The transportation of equipment and materials to site from the border with China utilises paved highways and dual carriageways which are suitable for and regularly used by HGV vehicles. Upgrade works may be required for several roads in the vicinity of the Project site due to the presence of potholes and poorly maintained bridges. This would be verified through further route inspection prior to construction.

Mitigation has been proposed to alleviate potential impacts and these measures will be incorporated into a Construction TMP for use prior to and during construction.

Overall, the assessment concludes that there will be no significant residual effects associated with transportation of materials and equipment during the construction and operation phases of the Project.

8.9.1 Construction Phase

8.9.1.1 Vehicle and Plant Requirements

Operator Authorisation

A person may only operate a vehicle or item of plant on the Project if they:

- Hold the appropriate licence (or statement of attainment for plant not covered by a licence) for the class of vehicle/plant being operated.
- Have completed the Project induction.
- Have undertaken a verification of competency assessment and been approved by a content expert.
- Are fit for work.
- Are under escort of an authorised person where access to work fronts is required (Delivery Drivers & Visitors only).

Vehicle and Plant Specifications

All vehicles and mobile plant must be fit for purpose and maintained to a safe and legal standard at all times, including roadworthy standards for vehicles and plant intended for use on a public road.

- Seat Belts: Occupants of any vehicle shall use seatbelts at all times. Where it is impossible to implement the requirement for buses or coaches or car, the minimum requirements are that the seat belts are fitted for driver, front seats and seats adjacent to doorway. Passengers should not occupy such seats if seatbelts are not fitted or functional.
- Condition of Tyres: The tread depth of all tyres including the spare shall not be less than 1.6 mm, or below the Tread Wear Indicator (TWI) embedded in tyres at the time of manufacturing. This applies to the whole area of the tyre. Tyres (including spare tyres) need to be maintained at the correct operating pressure.
- Premobilisation inspection: Prior to mobilisation, all vehicles shall be inspected by the HSE Safety Inspector and/or other agencies designated at site to verify compliance and will include all contractors and sub-contractors. Vehicles not meeting the requirements will be rejected. Vehicles shall be fit for purpose based on an assessment of usage, maintained in a safe working order in line with the manufacturers' specifications, servicing intervals and local legal requirements. Vehicles shall meet emission specifications as applicable in the country.
- Light Vehicles: All Vehicles as a minimum shall be fitted with working head lights, rear lights & brake lights, good tyres, seat belts, driver and passenger side mirrors, rear view mirror, reversing alarm, spare wheel and tyre.
- High Visibility Colour: High visibility colour should be preferred for light vehicles. Generally, bright light colours are better than darker colours as they reflect lighter and can be seen from up to four times the distance of vehicles painted in a darker colour.

- Authorisation: A stickering system is being developed showing vehicles inspected and approved for use and will be added once it is ready. There are no current plans have a requirement to use GPS/tracking. Only authorised vehicles will be permitted within the site area. Other vehicles shall require to be parked in the designated parking area.
- Heavy Vehicles: In addition to the above minimum requirements given for light vehicles, additional appropriate equipment shall be installed / provided in heavy vehicles.
- Mobile plant in areas of operation within the project worksite shall be fitted with the equipment including A flashing amber warning beacon clearly visible to approaching persons and traffic; an audible reversing alarm and emergency stop buttons.
- Grievances: A telephone number will be provided on Project vehicles to allow grievances to be reported.

8.9.1.2 Site Rules and Regulations

Site Security and Access

The Project site will be secured with a fenced perimeter boundary. There will be one main entry and exit point. Security measures will be taken to ensure the safety of the site as detailed in the Site Security Management Plan.

As a minimum, to enter the Project area it is expected that all workers meet the requirements of the Code of Conduct.

Delivery drivers and visitors can enter Project construction area without the above requirements if they are escorted by a person who is authorised to operate on the Site.

All persons will wear the site-specific PPE at all times (e.g. helmets, safety boots and high visibility clothing, gloves etc.) including delivery drivers. Any delivery driver failing to adhere to this will be refused access to the Site.

Signage

All appropriate signage will be installed for the direction of construction-related traffic and the safety of pedestrians.

Temporary and permanent signage on site should be positioned for maximum visibility to inform operators of speed restrictions, warnings and other critical traffic information for the area. Signage outside the Project site during construction must be in accordance with required specifications.

Banksmen or flagmen will be deployed at higher risk areas (road junctions, access, communities, schools etc) to manage project traffic and ensure TMP is being complied with.

Speed Restrictions

The following speed restrictions apply across the Project site:

- Site entry/exit – 20km/h.
- Laydown areas – 5 km/h.
- Satellite facilities and carpark – 5km/h.
- Main car park – 10km/h.
- Access roads – 30km/h or as Sign Posted.

Any adjustments to speed limits will be communicated via updated TMP and daily toolbox talks.

8.9.1.3 Right of Way

Emergency vehicles entering the Project site will have right of way at all times. Additionally:

- Mobile plant shall have right of way over heavy and light vehicles.
- Light vehicles shall give way to mobile plant and heavy vehicles.
- Pedestrians shall give way to all vehicles and mobile plant.

8.9.1.4 Internal Traffic Management

When assessing traffic-related risks, considerations should include (but not be limited to):

- Passing of high vehicles and loads under overhead power lines.
- Maintaining forward motion of vehicles and plant wherever possible to reduce reversing on site.
- Parking locations which do not obstruct access.
- Access for emergency vehicles.
- Unobstructed access to emergency assembly areas.
- Adequacy and visibility of signage.
- Delineation between mobile plant and pedestrians using physical barriers.
- Clearance from nearby infrastructure.

Supervisors will meet daily to plan and review construction works for the following day and where required will communicate any changes in traffic management for activities under their supervision via pre-start meetings.

8.9.1.5 Pedestrian Delineation

Adequate separation between vehicles and pedestrians will be established to ensure safety or, where not reasonably practicable, other means of protecting pedestrians and effective arrangements for warning, persons liable to be crushed or trapped by a vehicle, of its approach.

Pedestrian accesses which lead on to a traffic route will be sufficiently separated to enable them to see approaching plant and vehicles, from a place of safety.

Signage will be implemented to advise of unrestricted pedestrian areas and exclusion zones. Signage for exclusion zones and restricted access areas must identify the area supervisor to be contacted in the case of persons requiring entry into the area.

8.9.2 Operational Phase

Operational effects are likely to be minimal and limited to repair and maintenance work. No specific mitigation is required for operations although the general mitigation discussed for the construction phase would apply.

8.9.3 Decommissioning Phase

Decommissioning effects are likely to be similar to that during construction although reduced in magnitude. At this stage, it is not possible to quantify the traffic effect during decommissioning of the Project as it is considered to be too far in the future to estimate any baseline traffic flows. It is unlikely however to present any significant effects. Mitigation would be similar to construction phase.

9. Residual Impacts

9.1 Construction Impacts

The assessment has been undertaken in accordance with the methodology and assessment criteria set out in Section 4 (Assessment Methodology). The residual impacts are assessed following the implementation of mitigation as described in Chapter 8.

9.1.1 Air Quality

<table>
<tr><th colspan="6">Residual Impact Assessment: Impacts on air quality during construction</th></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td colspan="2">Medium</td><td>High</td></tr>
<tr><td colspan="5">Residential receptors are located approximately 100 m of the southern boundary of the Project site therefore receptor sensitivity is determined to be Medium.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>No change</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">Magnitude of change is anticipated to be medium as there is likely to be an increase in levels of dust to air associated with construction of the Project at nearby residential receptors.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The potential impact during construction is considered to be Medium adverse, on the basis that two residential receptors are approximately 100m from the site boundary and construction vehicles would pass closer to and from site. The implementation of Good International Industry Practise pollution prevention measures is considered very likely to reduce the impacts. However, additional mitigation measures are required.</td></tr>
<tr><td rowspan="2">Residual Impact Significance post mitigation</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The implementation of Good International Industry Practise pollution prevention measures is considered very likely to reduce the impacts to Low.</td></tr>
</table>

9.1.2 Archaeology and Cultural Heritage

<table>
<tr><th colspan="6">Impact Assessment: Impacts on archaeology and cultural heritage during construction</th></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td colspan="2">Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">There are no known heritage assets within the Solar Array area. Possible remains of levelled burial mounds (kurgans) have been identified in the vicinity of the Transmission Line and associated burials and ceremonial features may be present.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td colspan="2">No change</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The magnitude of change on archaeology is anticipated to be low as there is localised potential to physically disturb any surviving remains.
Setting impacts related to cemetery ACH119 adjacent to the Solar Array site, are not capable of effective mitigation, resulting in a medium score for impact magnitude.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The impact is assessed as medium prior to additional mitigation measures being implemented.</td></tr>
<tr><td rowspan="2">Residual Impact Significance post mitigation</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The residual impact is assessed as Negligible and not significant following mitigation measures being implemented.</td></tr>
</table>

9.1.3 Biodiversity

9.1.3.1 Avifauna

Impact Assessment: Impacts on ornithology during construction (PBF species) – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The PBF bird species which have been recorded as present or assessed as having a reasonable likelihood of occurrence are not critical habitat qualifying species and are therefore not of very high or high sensitivity according to the criteria detailed above. In terms of the PBF species which have been recorded, these have been recorded in numbers which are not significant and are assigned a Medium sensitivity value. Very small numbers of IBA qualifying species were recorded within the Project site, however the numbers recorded are unlikely to be significant (defined as >1%) of the IBA population. The project does not support breeding populations for PBF birds and the habitat is not suitable for these species. Sociable lapwing (IUCB [CR]) has the potential to occasionally overfly the project site on spring and autumn passage. However, there is no reasonable likelihood that the project is located on a significant migratory corridor for this species and the sensitivity is assessed a Low.				
Impact Magnitude	Negligible	Low	Medium	High	
	For the Solar PV the magnitude of the effect is predicted to be Negligible for breeding PBF birds given their likely absence from the Solar PV Project site. The magnitude of the effect is predicted to be Low for non-breeding birds PBF raptor species overflying on spring and autumn migration, in terms of disturbance displacement (barrier to movement) during the construction phase. The magnitude of the effect for the Overhead Line is expected to be Negligible in terms of breeding by PBF birds considering the likely absence of nest sites at the areas to be cleared within the respective very localised pylon footprints. The magnitude of the barrier effect is predicted to be Low for non-breeding birds PBF raptor species overflying the AOI on spring and autumn migration, in terms of disturbance displacement (barrier to movement) during the construction phase.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as Negligible and Low for PBF bird species and not significant for the Solar PV and the Overhead Line, respectively. There is a requirement for the project to achieve No Net Loss of species defined as PBFs.				

Impact Assessment: Impacts on ornithology (non PBF species) during construction					
Impact Nature	Positive	Negative			
	Impact is negative because construction activities may result in habitat loss and disturbance.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The Solar PV footprint supports a limited assemblage of breeding species which are not of international or national conservation concern. This ornithological receptor has been assessed as Low value.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect for the Solar PV site is predicted to be Medium given the area of the site that will require to be cleared and / or disturbed and that there is potential for				

Impact Assessment: Impacts on ornithology (non PBF species) during construction					
	loss/damage to eggs and nests of common ground nesting birds if site clearance occurs during the breeding bird season. The magnitude of the effect for the Overhead Line is expected to be Low as the areas to be cleared within the respective pylon footprints will be very localised. Therefore, the magnitude of the effect for the Project site is assessed as Medium (overall).				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as Low and not significant, however it is recommended standard mitigation measures are implemented to ensure impacts remain minimal.				

9.1.3.2 Terrestrial Ecology

Impact Assessment: Impacts on a CH species: Tajikistan Toadhead Agama (*Phrynocephalus sogdianus*) – Critical Habitat has been triggered under IFC Criterion 1 and EBRD Criterion ii - during Construction					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are applicable for Tajikistan toadhead agama. This species is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands and up to 30 individuals were found in sand dune/semi-fixed sand habitat in the vicinity of the Overhead Line route at the Khaudag Ridge during reptile surveys completed in April 2022. Habitats within the Overhead Line route in the Khaudag Ridge area are considered suitable for this species and are contiguous to the area where individuals were recorded in 2022. The EAAA used for the CHA has therefore been determined to include areas of suitable habitat that are likely contiguous with the Overhead Line route which are not separated or modified by agriculture or urbanisation; it is calculated to be 250km^2 (refer to Appendix D). This species is therefore assigned a 'High' sensitivity value for the Overhead Line element of the project. None were recorded in or around the Solar PV Site and habitats in this area are considered unsuitable; the Solar PV does not support sand dune habitat required by this species. Tajikistan toadhead agama is therefore assigned a 'Negligible' sensitivity value for the Solar PV element of the project.				
Impact Magnitude	Negligible	Low	Medium	High	
	This species is likely absent from the Solar PV site so the magnitude of impact for this element of the project is Negligible. The magnitude of the impact for the <u>Overhead Line</u> is expected to be <u>Low</u> for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Medium and significant for the Overhead Line crossing of the Khaudag Ridge and None for the Solar PV element of the project. There is a requirement for the project to achieve Net Gains for this Critical Habitat qualifying species. The mitigation measures required to achieve net gain will be detailed within a Biodiversity Action Plan (BAP) for the species.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The residual impact will be informed by the mitigation measures detailed in the BAP. There is a requirement for the project to achieve a Net Gain for CHs. As a result the project will result in a Low positive for CH qualifying species.				

Impact Assessment: Impacts on Smooth Even-fingered Gecko (*Alsophylax laevis*), a Critically Endangered Species - during Operation					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are not applicable for southern even-fingered gecko, however this species is listed as Critically Endangered by the IUCN. This species was not recorded during any of the daytime or nocturnal reptile surveys and is likely absent from the Project area. Nazarov (2020) suggested that the most suitable habitat for this species, within the AOI of the Project site, is the riparian habitat at the Karasu river valley crossing. The OHTL will cross the river as a free span therefore no works will take place within the river valley. This species is assigned a 'High' sensitivity value given its conservation status.				
Impact Magnitude	Negligible	Low	Medium	High	
	A high proportion of the habitat will be shaded by the solar panels and therefore the magnitude of the effect is predicted to be precautionarily assessed as Medium (overall) for this species assuming that it is present within the Solar PV site. Based on the initial site design, a total of 7.34 ha land would be cleared or just under 1.2% of the overall site area. This area currently does not include land required for internal access roads. It is estimated that there would be an additional 1% coverage by roads taking the area of habitat lost to 2.2%. There would be 228.6ha shaded by panels or 37% of the site area. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site. The magnitude of the impact for the Overhead Line is expected to be Low for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no impacts are expected for this sensitive habitat area for smooth even-fingered gecko. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to construction activities is assessed as Negligible .				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant for the Solar PV and OHTL. Southern even-fingered meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. There is therefore the requirement for the project to achieve No Net Loss of species.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The residual impact will be informed by the mitigation measures detailed in the BAP. There is a requirement for the project to achieve a NNL for PBFs. As a result the project will result in a Negligible impact on PBFs.				

Impact Assessment: Impacts on other PBF species: Central Asian tortoise, Boettiger Caspian toadhead agama, black ocellated racerunner, Transcaspian desert monitor, Indian gamma snake, Afghan awl-headed snake, northern (barred) wolf snake, tartar sand boa and marbled polecat					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	Very High

	These PBF reptile species are assigned a Medium value due to their presence or potential presence within the Project AoI and their respective inclusion as species listed on the Red Data Book of Uzbekistan. Marbled polecat is assigned Vulnerable status by IUCN. All PBF faunal species present or potentially present within the Project AoI are assigned Medium value for both elements of the Project (ie. Solar PV and Overhead Line).				
Impact Magnitude	Negligible	Low	Medium	High	
	A high proportion of the habitat will be disturbed for the roads, hardstandings, roads and solar panel bases and therefore the magnitude of the effect is predicted to be precautionarily assessed as Medium (overall) for terrestrial ecology. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality of fauna and *Chesneya tribuloides* due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site. The magnitude of the impact for the Overhead Line is expected to be Low for terrestrial ecology, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small, including the Khaudag sensitive reptile area. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no impacts are expected for this sensitive reptile habitat.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Medium for the Solar PV and therefore significant. The impact is assessed as Low for the operational Overhead Line and not significant. A suite of both standard mitigation measures and species-specific mitigation measures will be implemented to ensure impacts are not significant.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The residual impact will be informed by the mitigation measures detailed in the BAP. There is a requirement for the project to achieve a NNL for PBFs. As a result the project will result in a Negligible impact on PBFs.				

Impact Assessment: Impacts on other terrestrial ecology (non PBF species) during construction			
Receptor Value / Sensitivity	Low	Medium	High
	All non-PBF faunal species present or potentially present within the AoI are assessed as not exceeding medium value and are assigned Negligible-Medium value. The Uzbekistan Red Listed flowering plant Chesneya tribuloides is also assigned a Medium value for the operational Solar PV site, as it is assumed that the plant, which grows on the steep-sloped periphery of the site, will be undisturbed retained during the construction phase and therefore will be retained in situ within the operational solar farm design (ie. it is assumed that the steep slopes of the western escarpment are unsuitable for solar panels or other solar farm infrastructure/access roads and will not be impacted by earthworks). No habitat types or ecosystems were present or identified as being potentially present for the Solar PV/Overhead Line that would be considered as priority habitats as such Criterion 1: Threatened Habitat (PBF guidelines as set out in EBRD PR6 GN) [refer to Appendix D: Critical Habitat Assessment Report [Turnston Ecology, 2022)]. However, fragmented areas of Natural Habitat (degraded) occurs within the Solar PV and the Overhead Line crosses the Shuratakum Gorge, Karasu River and Khaudag Ridge, which also support Natural Habitat (degraded). Therefore a Medium sensitivity is assigned for the Soalr PV and Overhead Line.		

Impact Assessment: Impacts on other terrestrial ecology (non PBF species) during construction					
	Therefore, the overall value for sensitivity of the terrestrial ecological receptors is Medium (overall) for both elements of the Project (ie. Solar PV and Overhead Line).				
Impact Magnitude	No change	Negligible	Low	**Medium**	High
	The magnitude of the effect is predicted to be Medium given the area of the Project site that will require to be cleared and / or disturbed. The magnitude of the effect for the Solar PV site is predicted to be Medium given the area of the site that will require to be cleared and / or disturbed and that there is potential for loss/mortality of reptiles and small mammals. The magnitude of the effect for the Overhead Line is expected to be Low, as the areas to be cleared within the respective pylon footprints will be very localised. Therefore, the magnitude of the effect for the Project site is assessed as Medium (overall).				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the impact is assessed as Low and not significant. A suite of both standard mitigation measures[134] and species-specific mitigation measures will be implemented to ensure impacts are reduced to Low significance or below.				
Residual Impact Significance post mitigation	None	**Negligible**	Low	Medium	High
	The residual impact is predicted to be Negligible and not significant.				

9.1.4 Geology and Soils

Impact Assessment: Impacts on soil quality during construction					
Receptor Value / Sensitivity		Negligible	**Low**	Medium	High
	The sensitivity of soils in the Project area is assessed as Low. Whilst it is recognised that soils will be most vulnerable during high rainfall and snowmelt, the limited geographical extent does not require higher sensitivity.				
Impact Magnitude	No change	Negligible	**Low**	Medium	High
	The magnitude of the effect is predicted to be Low, given that there is potential for construction activities to notably change the resource, particularly during rainy season. Impacts of fuel spills are deemed to be highly localised.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the significance of the impact is assessed as Low. The extent of reduced soil quality due to construction activities is considered local, and the duration assessed as being temporary and short-term.				
Residual Impact Significance post mitigation	None	**Negligible**	Low	Medium	High
	Good International Industry Practise pollution prevention measures will be implemented, reducing the impact further.				

[134] For example: NetRegs (2020). Guidance for Pollution Prevention (GPP). Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

9.1.5 Hydrology and Hydrogeology

9.1.5.1 Surface Water

Impact Assessment: Impacts on surface water during construction					
Receptor Value / Sensitivity	Negligible	Low	**Medium**	High	
	The sensitivity of surface water is assessed as Medium, recognising that the canals are a source of irrigation water.				
Impact Magnitude	No change	Negligible	**Low**	Medium	High
	The magnitude of the effect is predicted to be low given the limited area of the Project site in relation to the overall catchment area.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the significance of the impact is assessed as Low. The extent of reduced surface water quality due to construction activities is considered local, and the duration assessed as being temporary and short-term. Mitigation will involve the implementation of Good International Industry Practise pollution prevention measures.				
Residual Impact Significance post mitigation	None	**Negligible**	Low	Medium	High
	Good International Industry Practise pollution prevention measures will be implemented, reducing the impact further.				

9.1.5.2 Groundwater

Impact Assessment: Impacts on groundwater during construction					
Receptor Value / Sensitivity	Negligible	**Low**	Medium	High	
	The sensitivity of groundwater is assessed as low, recognising that groundwater is not abstracted by local residents.				
Impact Magnitude	No change	Negligible	**Low**	Medium	High
	The magnitude of the effect is predicted to be low, given that the depth of the groundwater is greater than 15 m and is likely to be considerably deeper.				
Impact Significance	None	Negligible	**Low**	Medium	High
	The potential impact during construction is considered to be Low adverse, on the basis that no farmers abstract groundwater for their use. The implementation of Good International Industry Practise pollution prevention measures is considered to make the contamination of groundwater very unlikely.				
Residual Impact Significance post mitigation	None	**Negligible**	Low	Medium	High
	Good International Industry Practise pollution prevention measures will be implemented, reducing the impact further.				

9.1.6 Labour and Working Conditions

Impact Assessment: Occupational health and safety impacts during operation					
Receptor Value / Sensitivity	Low	Medium	High		
	The receptors in this case are the operational workers. Although there will be few personnel involved in the operational and maintenance activities (approximately 25), each individual is of high value/sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Occupational health and safety impacts could result in disease, injury, or death to workers and so the magnitude is high.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact is assessed as High and significant.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	Through the full implementation of the ESMS. ESMP and appropriate policies, the residual impact is predicted to be Low.				

9.1.7 Landscape and Visual

Impact Assessment: Impacts on Landscape Character					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity this landscape is assessed to be Low as it is not important in a local context. It is noted that the landscape is not designated at the local or national level and is influenced by man-made features.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be low, as it is unlikely that construction works become the dominant feature in an area already impacted by human activity.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the significance of the impact is assessed as low. Although impacts will be visible in places, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be easily accommodated.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	As changes can be easily accommodated in the landscape, no further mitigation is proposed.				

Impact Assessment: Impacts on Visual Amenity					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity of the site is assessed to be High at VP1 cemetery and assessed as the worst case. The land at which the Project is located is flat, with very few trees, hedges or fences to obscure visibility, and as such visibility can extend for several kilometres. This applies to VP1 on the centre of the site. Sensitivity is lower at VP2 and VP3 to the north and south. Views from the south are often limited by the earthen bund that runs along the canal.				
Impact Magnitude	No change	Low	Medium	High	
	The magnitude of the effect is predicted to be low, because the visual impact of ground-level features is likely to be low, except at close range, due to the lack of vantage points overlooking the landscape.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the significance of the impact is assessed as Medium. Although impacts will be visible in places, particularly at the cemetery, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be generally accommodated.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	As changes can be easily accommodated in the wider landscape, no further mitigation is proposed.				

9.1.8 Noise

Impact Assessment: Impacts on noise during construction					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	Two residential receptors are located 100 m from the Project site therefore receptor sensitivity is determined to be medium. It is noted that a 4m earth bund created when the canals were constructed will provide a degree of noise attenuation, reducing the impact.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Medium as there is likely to be an increase in noise levels associated with construction of the Project at the closest residential receptors.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, on the basis that residential receptors are 100m from the site boundary. The implementation of Good International Industry Practise pollution prevention measures is considered very likely to reduce the impacts.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Low adverse. Other than the implementation of GIIP, no further mitigation is proposed.				

9.1.9 Socio-economic Impacts

9.1.9.1 Community expectations of the Project

Impact Assessment: Community expectations of the Project				
Impact Magnitude	Negligible	Low	Medium	High
	Sherabad is a predominantly rural area and thus its population may not have a clear understanding of the employment opportunities created by industrial development. However, the levels of unemployment in the Sherabad region are low and therefore expectations may be lower at the regional level. Therefore, the impact magnitude is medium at the local level (<5km) but reducing to Low at the regional level.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is low given that local communities and local economically active population are not depending on this Project specifically as their main source of income. However, this impact has the potential to increase unmanaged expectations among the unemployed and more vulnerable groups.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is Low. This is an adverse impact and the ongoing consultation and dissemination of Project information will be included in the Stakeholder Engagement Plan currently under development. This impact will be continuously managed throughout the construction phase (and ongoing operation phase).			
Residual Impact Significance post mitigation	Negligible	Low	Medium	High
	Although the ongoing consultation and dissemination of Project information will be managed through the SCA and LRP process and the Stakeholder Engagement Plan, this impact will be continuously managed throughout the construction phase (and ongoing operation phase). As a result, residual impacts will remain Low.			

9.1.9.2 Economic Displacement

Impact Assessment: Economic displacement				
Impact Magnitude	Negligible	Low	**Medium**	High
	The impact magnitude is Medium as there is the potential to result in economic resettlement, particularly of herders.			
Receptor Value / Sensitivity	Negligible	**Low**	Medium	High
	The receptor value is Low for leaseholders along the OHTL given they will have sufficient land remaining and for herders who make use of alternative higher quality land.			
Impact Significance	Negligible	Low	**Medium**	High
	The overall impact significance is Medium and specific mitigation in the form of cash compensation and livelihood restoration has been developed as part of the LRP.			
Residual Impact Significance post mitigation	Negligible	**Low**	Medium	High
	The residual impact is predicted to be Low.			

9.1.9.3 Loss of public access and reduced mobility through local paths

Impact Assessment: Impacts from a loss of public access to footpaths inside the project area				
Impact Magnitude	Negligible	Low	**Medium**	High
	The impact magnitude is Medium as the impact is perceptible to the local farms and will represent a relevant change to their baseline conditions in terms of local grazing areas.			
Receptor Value / Sensitivity	Negligible	**Low**	Medium	High
	The receptor value is Low for leaseholders along the OHTL given they will have sufficient land remaining and for herders who make use of alternative higher quality land.			
Impact Significance	Negligible	Low	**Medium**	High
	The receptor value is Medium given that local communities and local herders rely on these pathways for access to livelihoods.			
Residual Impact Significance post mitigation	Negligible	**Low**	Medium	High
	The residual impact is predicted to be Low.			

9.1.9.4 Reduced access to grazing and pastoral land

Impact Assessment: Reduced access to grazing and pastoral land				
Impact Magnitude	Negligible	Low	**Medium**	High
	The impact magnitude is medium as the impact is perceptible to the local farms and will represent a relevant change to their baseline conditions in terms of local grazing areas.			
Receptor Value / Sensitivity	Negligible	Low	**Medium**	High
	The receptor's senitivities is predicted to be Medium, depending on their access to alternative land. This will be investigated further in the SCA/LRP. All people interviewed said the land is of such poor quality and herders don't use it much.			
Impact Significance	Negligible	**Low**	Medium	High
	Based on the information available the impact is assessed as Low adverse, pre-mitigation.			
Residual Impact Significance post mitigation	Negligible	**Low**	Medium	High
	This will be assessed further as part of the LRP and if necessary additional mitigation would be developed.			

9.1.9.5 Increased presence of workers and interaction with local communities

Impact Assessment: Increased presence of workers and interaction with local communities				
	Negligible	Low	**Medium**	High

Impact Magnitude	The impact magnitude is Medium because the potential for workers to travel and interact with local residents may extend past the Project AoI. Both residents and workers may be exposed to increased health and safety risks.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the actual location of worker accommodation. Whereas Kattakurgan will have sufficient means to adapt, other localities such as may not have the same resilience to intake a large workforce or prevent their vulnerable groups from this potential increase to community H&S risks. Depending on the workforce composition, vulnerable worker population may be more sensitive to avoiding or treating communicable diseases, and this will have to be identified as a priority during the planning stage.			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium pre-mitigation.			
Residual Impact Significance post mitigation	Negligible	Low	Medium	High
	The residual impact during construction is considered to be Low post-mitigation.			

9.1.9.6 Increased presence of security personnel

Impact Assessment: Increased presence of security personnel				
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium because the potential for security guards to interact with local community members is a very perceptible change to the baseline conditions of ample passage and access to the site area.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the timing of previous disclosure of Project starting activities.			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, pre-mitigation.			
Residual Impact Significance post mitigation	Negligible	Low	Medium	High
	The residual impact during construction is considered to be Low post-mitigation.			

9.1.9.7 Increased levels of gender-based violence, sexual exploitation and harassment

Impact Assessment: Increased levels of gender-based violence, sexual exploitation and harassment				
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is High as women and children are regarded as vulnerable receptors.			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, pre-mitigation. It is expected that the continued implementation of specific measures introduced during the construction phase to prevent and address GBVSEH), will reduce this to Low.			
Residual Impact Significance post mitigation	Negligible	Low	Medium	High
	The residual impact during construction is considered to be Low post-mitigation.			

9.1.10 Traffic and Transportation

Impact Assessment: Impacts on traffic during construction					
Receptor Value / Sensitivity	Low	Medium	High		
	Although the transportation route passes a number of towns, the road is likely to have existing HGV traffic and the receptor sensitivity is determined to be low. At the local level, settlements are small with few amenities and sensitivity is expected to be High.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Low at the regional level as the increased number of HGV movements is not expected to exceed 30% above baseline for major roads. At the local level, impacts are likely to be High given that no HGV traffic is likely to use the local dirt roads on a regular basis.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant at the regional level. At the local level the impact is High significance. Standard good construction practice will be maintained to ensure no increase in predicted impacts during construction and a TMP will be prepared.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	A TMP will be implemented and the residual impact will remain as Low.				

9.2 Operational Impacts

9.2.1 Air Quality

Impact Assessment: Impacts on air quality during operation					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	Residential receptors are located 100 m of the Project site therefore receptor sensitivity is determined to be Medium.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Negligible as almost no ground disturbance will take place.				
Impact Significance	None	Negligible	Low	Medium	High
	Residential receptors are located 100 m of the Project site but lack of ground disturbance means the impact significance is deemed to be negligible.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The residual impact during construction is considered to be Negligible.				

9.2.2 Archaeology and Cultural Heritage

Impact Assessment: Impacts on archaeology and cultural heritage during operation					
Receptor Value / Sensitivity	Low	Medium	High		
	Any archaeological remains within the Project footprint will have been recorded and removed during the construction phase. However, the impact of the Solar PV Array on the setting of the high community value Islamic cemetery ACH119 will persist throughout the operational life of the Project. The sensitivity for the heritage topic is therefore assessed as High.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	No works will be taking place other than maintenance and security. No physical impacts on archaeological remains are predicted. The new Transmission Line will impact on the setting of heritage assets. Setting impacts related to cemetery ACH119 adjacent to the Solar Array site, are not capable of effective mitigation, resulting in a medium score for impact magnitude.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as medium prior to additional mitigation measures being implemented.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	There are not deemed to be mitigation measures available to screen the cemetery from the project therefore the residual impact remains Medium.				

9.2.3 Biodiversity

9.2.3.1 Avifauna

Impact Assessment: Impacts on Ornithology (PBF species) during Operation – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	Very High
	The PBF bird species which have been recorded as present or assessed as having a reasonable likelihood of occurrence are not critical habitat qualifying species and are therefore not of very high or high sensitivity according to the criteria detailed above. In terms of the PBF species which have been recorded, these have been recorded in numbers which are not significant and are assigned a Medium sensitivity value. The occurrence of steppe eagle, Egyptian vulture, eastern imperial eagle and little bustard is likely to be restricted to				

Impact Assessment: Impacts on Ornithology (PBF species) during Operation – Saker Falcon, Steppe Eagle, Egyptian Vulture, Eastern Imperial Eagle, Eurasian Griffon Vulture, Little Bustard and Lammergeier.	
	overflying the AoI on spring and autumn migration. Resident raptor species (ie saker falcon, Egyptian vulture, Eurasian griffon vulture, little bustard and lammergeier) may use the AoI for hunting/foraging, but saker falcon is the only potential nesting species of concern, although there were no records of this species from the baseline surveys (including nesting on existing pylons adjacent to the proposed Overhead Line route). There is no suitable cliff habitat which would provide opportunities for large raptors (eg. Egyptian vulture), at the Khaudag Ridge and other areas along the Overhead Line route. The Solar PV footprint does not support breeding populations for PBF bird species due to the unsuitability of the habitat. The PBF breeding bird sensitivity is determined as Low for the Solar PV and Overhead Line elements of the Project.
Impact Magnitude	Negligible / **Low** / **Medium** / High
	Permanent loss and change of habitat for the Solar PV would be an effect of Negligible magnitude for the breeding, wintering and migratory birds which have determined to be PBF species . Permanent loss of habitat for the Overhead Line would be an effect of Low magnitude for breeding, wintering and migratory birds which may utilise habitat within the operational footprint , with only small areas are taken up by Overhead Line infrastructure (ie. pylon bases). The operational Solar PV and Overhead Line will result in partial reduction of bird activity through the displacement of birds; this is assessed as Medium magnitude for PBF birds. The 52km Overhead Line alignment is an extensive alignment in terms of migrating birds passing through the wider Surkandarya region on a broad front and it is orientated along an approximately east--west alignment, which increases the potential barrier effect of the power line/pylons with respect to birds migrating through the Project site south to north (in spring) or north to south (in autumn); an east-west alignment is potentially more impactful in this respect (compared to a north-south alignment). The magnitude of this potential impact is assessed as Medium for steppe eagle, Egyptian vulture, eastern imperial eagle and little bustard. The impact magnitude is assessed as Medium (overall) for the Overhead Line The impact magnitude is assessed as Low for the PVProject
Impact Significance	None / Negligible / **Low** / **Medium** / High
	The potential impact is assessed as Medium and significant for the Overhead Line The potential impact is assessed as Low and not significant for the Solar PV. Mitigation will be required to ensure impacts for the Overhead Line are not significant.
Residual Impact Significance post mitigation	None / **Negligible** / Low / Medium / High
	The residual impact will be informed by the mitigation measures detailed in the BAP. There is a requirement for the project to achieve No Net Loss of species defined as PBFs. As a result the project will result in a residual impact of Negligible for PBFs.

Impact Assessment: Impacts on Ornithology (non PBF species) during Operation					
Receptor Value / Sensitivity	Negligible	Low	**Medium**	High	Very High

Impact Assessment: Impacts on Ornithology (non PBF species) during Operation					
	The Solar PV and the Overhead Line are assigned a Medium sensitivity overall in terms of the overflying (eg. migratory) bird assemblages which occur.				
Impact Magnitude	Negligible	Low	Medium	High	
	The impact magnitude is assessed as Medium (overall) for the Overhead Line The impact magnitude is assessed as Low for the Project				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact is assessed as Medium and significant for the Overhead Line The potential impact is assessed as Low and not significant for the Solar PV.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The residual impact is predicted to be Negligible and not significant.				

9.2.3.2 Terrestrial Ecology

Impact Assessment: Impacts on a CH species: Tajikistan Toadhead Agama (*Phrynocephalus sogdianus*) – Critical Habitat has been triggered under IFC Criterion 1 and EBRD Criterion ii - during Operation					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are applicable for Tajikistan toadhead agama. This species is a typical representative of psammophilic reptiles and lives only in sand dunes and semi-fixed sands and up to 30 individuals were found in sand dune/semi-fixed sand habitat in the vicinity of the Overhead Line route at the Khaudag Ridge during reptile surveys completed in April 2022. Habitats within the Overhead Line route in the Khaudag Ridge area are considered suitable for this species and are contiguous to the area where individuals were recorded in 2022. The EAAA used for the CHA has therefore been determined to include areas of suitable habitat that are likely contiguous with the Overhead Line route which are not separated or modified by agriculture or urbanisation; it is calculated to be 250km^2 (refer to Appendix D). This species is therefore assigned a ‘High’ sensitivity value for the Overhead Line element of the project. None were recorded in or around the Solar PV Site and habitats in this area are considered unsuitable; the Solar PV does not support sand dune habitat required by this species. Tajikistan toadhead agama is therefore assigned a ‘Negligible’ sensitivity value for the Solar PV element of the project.				
Impact Magnitude	Negligible	Low	Medium	High	
	This species is likely absent from the Solar PV site so the magnitude of impact for this element of the project is Negligible. The magnitude of the impact for the Overhead Line is expected to be Low for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag Ridge. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline.				
	None	Negligible	Low	Medium	High

<table>
<tr><th colspan="6">Impact Assessment: Impacts on a CH species: Tajikistan Toadhead Agama (Phrynocephalus sogdianus) – Critical Habitat has been triggered under IFC Criterion 1 and EBRD Criterion ii - during Operation</th></tr>
<tr><td>Impact Significance</td><td colspan="5">The impact is assessed as Medium and significant for the Overhead Line crossing of the Khaudag Ridge and None for the Solar PV element of the project.

There is a requirement for the project to achieve Net Gains for this Critical Habitat qualifying species. The mitigation measures required to achieve net gain will be detailed within a Biodiversity Action Plan (BAP) for the species.</td></tr>
<tr><td rowspan="2">Residual Impact Significance post mitigation</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The residual impact will be informed by the mitigation measures detailed in the BAP. There is a requirement for the project to achieve a Net Gain for CHs. As a result the project will result in a Low positive for CH qualifying species.</td></tr>
</table>

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Smooth Even-fingered Gecko (Alsophylax laevis), a Critically Endangered Species - during Operation</th></tr>
<tr><td rowspan="2">Receptor Value / Sensitivity</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022), critical habitat requirements are not applicable for southern even-fingered gecko, however this species is listed as Critically Endangered by the IUCN and is assigned a High significance.</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">Magnitude is assessed as Negligible for this species as neither the Solar PV site or OHTL offer suitable habitat. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site.

The magnitude of the impact for the Overhead Line is expected to be Negligible for this species, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small at the Khaudag. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no operational impacts are expected for this sensitive habitat area for smooth even-fingered gecko. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The impact is assessed as Low and not significant overall.</td></tr>
<tr><td rowspan="2">Residual Impact Significance post mitigation</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The residual impact will be informed by the mitigation measures detailed in the BAP. There is a requirement for the project to achieve No Net Loss of species defined as PBFs. As a result the project will result in a residual impact of Negligible for PBFs.</td></tr>
</table>

Impact Assessment: Impacts on other PBF species: Central Asian tortoise, Boettiger Caspian toadhead agama, black ocellated racerunner, Transcaspian desert monitor, Indian gamma snake, Afghan awl-headed snake, northern (barred) wolf snake, tartar sand boa and marbled polecat						
Receptor Value / Sensitivity	Negligible	Low	Medium	High	Very High	
	These PBF reptile species are assigned a Medium value due to their presence or potential presence within the Project AoI and their respective inclusion as species listed on the Red Data Book of Uzbekistan. Marbled polecat is assigned Vulnerable status by IUCN. All PBF faunal species present or potentially present within the Project AoI are assigned Medium value for both elements of the Project (ie. Solar PV and Overhead Line).					
Impact Magnitude	Negligible	Low	Medium	High		
	A high proportion of the habitat will be permanently covered by the solar panels bases and therefore the magnitude of the effect is predicted to be precautionarily assessed as Medium (overall) for terrestrial ecology. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality of fauna and *Chesneya tribuloides* due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site. The magnitude of the impact for the <u>Overhead Line</u> is expected to be <u>Low</u> for terrestrial ecology, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small, including the Khaudag sensitive reptile area. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no operational impacts are expected for this sensitive reptile habitat. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline. In terms of potential collision risk to bats for the OHTL element of the project, the proposed powerline line is not routed through suitably favourable habitat (eg. woodland edge or linear wetland feature) that may be used regularly for commuting and / or foraging (e.g. commuting to and from a building roost to a foraging area between which the overhead line was located) there would be a theoretical collision risk to bats. Bats are extremely agile flyers and have a highly developed echolocation system which they use for navigation and prey capture; the species that could be present are able to fly through and negotiate complex environments including foraging around tree canopies and building complexes. Therefore, due to their highly developed flight skills and the relatively static nature of the powerlines, there would be a negligible collision risk posed by the proposed overhead line.					
Impact Significance	None	Negligible	Low	Medium	High	
	The impact is assessed as Medium for the Solar PV and therefore significant. The impact is assessed as Low for the operational Overhead Line and not significant. A suite of both standard mitigation measures and species-specific mitigation measures will be implemented to ensure impacts are not significant.					
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High	
	The residual impact will be informed by the mitigation measures detailed in the BAP. There is a requirement for the project to achieve No Net Loss of species defined as PBFs. As a result the project will result in a residual impact of Negligible for PBFs.					

Impact Assessment: Impacts on Terrestrial Species (other than species which have been assessed as PBFs) during Operation					
Receptor Value / Sensitivity	Negligible	Low	Medium	High	Very High

<table>
<tr><th colspan="6">Impact Assessment: Impacts on Terrestrial Species (other than species which have been assessed as PBFs) during Operation</th></tr>
<tr><td></td><td colspan="5">All non-PBF faunal species present or potentially present within the AoI are assessed as not exceeding medium value and are assigned Negligible-Medium value.

The Uzbekistan Red Listed flowering plant Chesneya tribuloides is also assigned a Medium value for the operational Solar PV site, as it is assumed that the plant, which grows on the steep-sloped periphery of the site, will be undisturbed retained during the construction phase and therefore will be retained in situ within the operational solar farm design (ie. it is assumed that the steep slopes of the western escarpment are unsuitable for solar panels or other solar farm infrastructure/access roads and will not be impacted by earthworks).

No habitat types or ecosystems were present or identified as being potentially present for the Solar PV/Overhead Line that would be considered as priority habitats as such Criterion 1: Threatened Habitat (PBF guidelines as set out in EBRD PR6 GN) [refer to Appendix D: Critical Habitat Assessment Report [Turnston Ecology, 2022)]. However, fragmented areas of Natural Habitat (degraded) occurs within the Solar PV and the Overhead Line crosses the Shuratakum Gorge, Karasu River and Khaudag Ridge, which also support Natural Habitat (degraded). Therefore a Medium sensitivity is assigned for the Soalr PV and Overhead Line.

Therefore, the overall value for sensitivity of the terrestrial ecological receptors is Medium (overall) for both elements of the Project (ie. Solar PV and Overhead Line).</td></tr>
<tr><td rowspan="2">Impact Magnitude</td><td>Negligible</td><td>Low</td><td>Medium</td><td colspan="2">High</td></tr>
<tr><td colspan="5">A high proportion of the habitat will be permanently lost for the solar panel bases and therefore the magnitude of the effect is predicted to be precautionarily assessed as <u>Medium (overall)</u> for terrestrial ecology. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality of fauna and Chesneya tribuloides due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational Solar PV site.

The magnitude of the impact for the <u>Overhead Line</u> is expected to be <u>Low</u> for terrestrial ecology, as the areas subject to permanent habitat loss from operational infrastructure (pylons) are small, including the Khaudag sensitive reptile area. There will be no loss of riparian habitat at the Karasu River crossing; therefore, no operational impacts are expected for this sensitive reptile habitat. The magnitude of impact in terms of potential impacts relating to disturbance/injury/mortality due to operational activities (eg. vehicle collisions) is assessed as Negligible during operation; there will be very limited personnel and vehicle movements within the operational powerline.

In terms of potential collision risk to bats for the OHTL element of the project, the proposed powerline line is not routed through suitably favourable habitat (eg. woodland edge or linear wetland feature) that may be used regularly for commuting and / or foraging (e.g. commuting to and from a building roost to a foraging area between which the overhead line was located) there would be a theoretical collision risk to bats. Bats are extremely agile flyers and have a highly developed echolocation system which they use for navigation and prey capture; the species that could be present are able to fly through and negotiate complex environments including foraging around tree canopies and building complexes. Therefore, due to their highly developed flight skills and the relatively static nature of the powerlines, there would be a negligible collision risk posed by the proposed overhead line.</td></tr>
<tr><td rowspan="2">Impact Significance</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">The impact is assessed as Medium for the Solar PV and therefore significant.

The impact is assessed as Low for the operational Overhead Line and not significant.

A suite of both standard mitigation measures and species-specific mitigation measures will be implemented to ensure impacts are not significant.</td></tr>
<tr><td rowspan="2">Residual Impact Significance post mitigation</td><td>None</td><td>Negligible</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td colspan="5">Taking a precautionary approach the residual impact is predicted to be Medium and significant.</td></tr>
</table>

9.2.4 Hydrology and Hydrogeology

Impact Assessment: Hydrology and hydrogeology impacts during operation					
Receptor Value / Sensitivity	Negligible	Low	**Medium**	**High**	
	The sensitivity of surface water is assessed as medium, recognising the fact that a small number of local residents use the two watercourses adjacent to the site for drinking water for livestock. The sensitivity of groundwater is assessed as high, recognising the fact that local communities abstract groundwater for domestic use from local wells.				
Impact Magnitude	No change	Negligible	**Low**	Medium	High
	The magnitude of the effect in relation to surface water is predicted to be low given the limited area of the Project site in relation to the overall catchment area. The magnitude of the effect in relation to groundwater is predicted to be low, given that the soil and superficial deposits present in the area are expected to provide protection to the groundwater, and that the use/handling of chemicals /oils/wastewater during operation will be limited.				
Impact Significance	None	Negligible	**Low**	**Medium**	High
	Pre-mitigation, the impact in relation to surface water is assessed as low, due to the limited extent. Pre-mitigation, the impact in relation to groundwater is assessed as Medium and significant.				
Residual Impact Significance post mitigation	None	Negligible	**Low**	Medium	High
	The residual impact is predicted to be Low and not significant.				

9.2.5 Geology and Soils

Impact Assessment: Impacts on soil quality during operation					
Receptor Value / Sensitivity	Negligible	**Low**	Medium	High	
	The soils are considered to have a low sensitivity.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	The magnitude of the effect during operation is very low, since there will be much less frequent traffic than during construction, and only occasional use of heavy equipment. In addition, the use/handling of chemicals /oils/wastewater during operation will be limited.				
Impact Significance	None	**Negligible**	Low	Medium	High
	The impacts are assessed as Negligible and insignificant.				
Residual Impact Significance post mitigation	None	**Negligible**	Low	Medium	High
	The residual impact is predicted to be Negligible and not significant.				

9.2.6 Glare and Glint

Impact Assessment: Glint and glare impacts during operation					
Receptor Value / Sensitivity	Low	Medium	**High**		
	There are safety concerns with regard to any potential to distract aircraft pilots and vehicle drivers, causing accidents leading to potential injuries or deaths.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on				

Impact Assessment: Glint and glare impacts during operation					
	solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation. The site is not close to or located on a flight path to and from a local airport.				
Impact Significance	None	Negligible	**Low**	Medium	High
	The impact is assessed as Low and not significant.				
Residual Impact Significance post mitigation	None	Negligible	**Low**	Medium	High
	The impact is assessed as Low and not significant.				

9.2.7 Labour and Working Conditions

Impact Assessment: Occupational health and safety impacts during operation					
Receptor Value / Sensitivity	Low	Medium			**High**
	The receptors in this case are the operational workers. Although there will be few personnel involved in the operational and maintenance activities (approximately 25), each individual is of high value/sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	**High**
	Occupational health and safety impacts could result in disease, injury, or death to workers and so the magnitude is high.				
Impact Significance	None	Negligible	Low	Medium	**High**
	Pre-mitigation, the impact is assessed as High and significant.				
Residual Impact Significance post mitigation	None	Negligible	**Low**	Medium	High
	Through the full implementation of the ESMS. ESMP and appropriate policies, the residual impact is predicted to be Low.				

9.2.8 Landscape and Visual Impacts

Impact Assessment: Impacts on Landscape Character					
Receptor Value / Sensitivity	**Low**	Medium		High	
	The sensitivity this LCT is assessed to be Low as it is not important in a local context, with no sites of interest in the location of the Project. It is noted that the LCTs are not designated at the local or national level. The landscape in the wider area is expansive rural which determines the overall character of the region as a whole.				
Impact Magnitude	No change	**Low**		Medium	High
	The magnitude of the effect is predicted to be Low, as it is unlikely that construction works become the dominant feature in an area already impacted by human activity.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the significance of the impact is assessed as low. Although impacts will be visible in places, the surrounding features such as OHTLs and pylons are of a larger scale in height and extent. Therefore, changes can be easily accommodated in all LCTs.				
Residual Impact Significance post mitigation	None	Negligible	**Low**	Medium	High
	The residual impact is predicted to be Low and not significant.				

Impact Assessment: Impacts on Visual Amenity				
Receptor Value / Sensitivity	**Low**	Medium	High	
	The sensitivity of all VPs are assessed to be Low as they are not important in a local or regional context. There are no sites of interest from a tourism perspective. The landscape in the wider area to the south is more industrialised which determines the context of the views experienced.			
	No change	**Low**	Medium	High

Impact Assessment: Impacts on Visual Amenity					
Impact Magnitude	The magnitude of the effect is predicted to be low, given that the significant screening provided and the expansive nature of the landscape reduce the magnitude of impacts experienced.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the significance of the impact is assessed as low. Although impacts will be visible in places, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be easily accommodated at all VPs. Views from the minor road will be transient in nature and dominated by exiting villages and natural features in this location.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The residual impact is predicted to be Low and not significant.				

9.2.9 Noise

Impact Assessment: Noise impacts during operation					
Receptor Value / Sensitivity	Low	Medium	High		
	There are settlements in relatively close proximity to the Project, receptors are of high sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The distance between the transformers and the nearest residential properties is considered sufficient to reduce any noise to an acceptable level, however the substation is located to the south of the site boundary in close proximity to receptors. Noise calculations have deemed operational noise to be within specified limits. A Low magnitude of change is therefore predicted.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant.				
Residual Impact Significance post mitigation	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant.				

9.2.10 Socio-economic Impacts

9.2.10.1 Impacts from local employment during operation

Impact Assessment: Impacts from local employment during operation				
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is low as the workforce required during operations is relatively small when compared to the construction stage.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is high as local employment during both construction and operations is a key expectation amongst local communities and their representatives. It is essential that Uzbeks comprise a significant component of the operational workforce.			
Impact Significance	Negligible	Minor	Medium	High
	As a result of the above, the overall impact is assessed as Medium and positive.			
Residual Impact Significance post mitigation	Negligible	Minor	Medium	High
	As a result of the above, the overall impact is assessed as Medium and positive.			

9.2.10.2 Impacts on the national and regional economy during operation

Impact Assessment: Impacts on the national and regional economy during operation				
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is medium as the quantity of energy generated by the project is an important contribution at 456.7 MW.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is medium as the countries' energy demand shall continue to increase during the lifespan of the project.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is Medium.			
Residual Impact Significance post mitigation	Negligible	Minor	Medium	High
	As a result of the above, the overall impact is assessed as Medium and positive.			

9.2.10.3 Potential for gender-based violence, sexual exploitation and harassment

Impact Assessment: Potential for gender-based violence, sexual exploitation and harassment				
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Low.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is High as women and children are regarded as vulnerable receptors.			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during operation is considered to be Medium adverse, pre-mitigation. It is expected that the continued implementation of specific measures introduced during the construction phase to prevent and address GBVSEH, will reduce this to Low.			
Residual Impact Significance post mitigation	Negligible	Low	Medium	High
	The residual impact during operation is considered to be negligible post-mitigation.			

9.2.11 Traffic and Transportation

The residual transport impacts will occur during the construction phase. The number of vehicles during operation is likely to be very low, with access required only for maintenance and servicing. The majority of these will be light vehicles and, at the worst case, a HGV trip may be required to transport a replacement transformer to site. The residual effects of traffic movements stemming from the operational phase are therefore considered Negligible and not significant.

9.3 Decommissioning Impacts

9.3.1 Air Quality

The change in ambient air quality may arise at decommissioning as a result of fugitive dust and particulate matter emissions. However, such impacts are expected to be temporary and of short-term nature as they are limited to the decommissioning phase only. The impacts will be similar to the construction phase.

9.3.2 Archaeology and Cultural Heritage

The activities which may impact upon archaeological and cultural heritage sites include an increased workforce presence, reinstatement activities and vehicle movements, which may result in damage to, or interference with, archaeological and cultural heritage sites. It is unlikely however to present any significant effects. Following the removal of the structures and the reinstatement of the land use there would be no further potential effects to the archaeology and cultural heritage receptors.

9.3.3 Biodiversity

Similar to construction, the main impacts during decommissioning are likely to comprise disturbance to birds. Following decommissioning, reinstatement will be important to re-establishing the ecosystem in areas previously occupied by solar panels, site roads and other structures. At the time of decommissioning, the sensitivity of some species, particularly those which are regionally rare, may have increased. For all PBF and CH qualifying species the BAP will ensure either NNL or NG respectively.

9.3.4 Terrestrial Ecology

Similar to construction, the main impacts during decommissioning are likely to comprise habitat loss, loss of small numbers of mammals, and disturbance to animals. Following decommissioning, reinstatement will be important to re-establishing the ecosystem in areas previously occupied by solar panels, site roads and other structures. At the time of decommissioning, the sensitivity of some species, particularly those animals which are regionally rare, may have increased.

9.3.5 Geology and Soils

Similar to construction, soils will be highly vulnerable to traffic and erosion during decommissioning. The movement of materials off-site may involve the construction of temporary roads and use of large vehicles. There is also potential for chemical or oil spills, or the incorrect handling/disposal of wastes during decommissioning. Similar measures to those outlined for the construction phase will need to be taken to minimize impacts on soils. Reinstatement of land and after-care will be critical to mitigating the damage to soils.

The panels and supports will be dismantled and steel and other useful materials will be recycled. Inert materials which cannot be recycled will be taken to a suitable disposal site. However, foundations and other inert belowground materials will be buried. This is not likely to have a significant impact on soils as it will not prevent re-vegetation or restoration of land.

9.3.6 Hydrology and Hydrogeology

Effects on water resources during decommissioning are likely to be similar to those during construction, so sensitive features such as drainage channels would need to be avoided. Contaminated materials such as oil storage tanks would need to be removed from the site and taken to a suitable disposal site to prevent future contamination of surface and groundwater.

9.3.7 Labor and working conditions

Similar to construction, the use of a workforce and decommissioning activities could potentially generate a variety of risks to the workforce, due to general site decommissioning activities (removal of site equipment and infrastructure) and the presence of project vehicles on local risks posing a risk to. An Occupational Health and Safety Plan, Traffic Management Plan and Emergency Response Plan will be in place for the decommissioning phase of the Project. Appropriate policies will be in place to protect worker's rights.

9.3.8 Landscape and visual

Impacts of landscape will result from removal of solar PV panels, substations and transformer stations, on-site and off-site transmission lines. New machinery and equipment will be introduced into the landscape, including heavy goods vehicles excavators, bulldozers, and other heavy equipment. The residual impacts are expected to be the same as those experienced during construction.

9.3.9 Noise

Local noise levels will be affected temporarily by decommissioning activities such as equipment movement during building demolition and use of heavy machinery. The impacts will be similar to those experienced during the construction phase.

9.3.10 Socio-economic Impacts

Similar to construction, the use of a workforce and decommissioning activities could potentially generate a variety of health and safety risks to the local residents, due to general site decommissioning activities (removal of site equipment and infrastructure) and the presence of project vehicles on local risks posing a risk to local residents and school children. A Community Health and Safety Plan, Traffic Management Plan and Emergency Response Plan will be in place for the decommissioning phase of the Project.

9.3.11 Transportation and Access

Decommissioning effects are likely to be similar to that during construction although reduced in magnitude. At this stage, it is not possible to quantify the traffic effect during decommissioning of the Project as it is considered to be too far in the future to estimate any baseline traffic flows. It is unlikely however to present any significant effects.

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Appendix A Species List

Common Name	Latin Name	IUCN Threatened[1]	URDB[2]	Solar PV	Overhead Line	Comment
Birds						
Barn Swallow	Hirundo rustica	x	x	✓	✓	Breeding summer visitor & passage migrant
Black-bellied Sandgrouse	Syrrhaptes orientalis	x	x	✓	✓	Resident
Black-headed Gull	Chroicocephalus ridibundus	x	x	✓	x	Non-breeding winter visitor
Black Kite	Milvus migrans	x	x	x	✓	Breeding summer visitor & passage migrant
Black-throated Accentor	Prunella atrogularis	x	x	x	✓	Non-breeding winter visitor
Calandra Lark	Melanocorypha calandra	x	x	✓	✓	Resident
Carrion/Hooded Crow	Corvus corone/cornix	x	x	✓	✓	Resident
Chaffinch	Fringilla coelebs	x	x	✓	✓	Non-breeding winter visitor
Cinereous Vulture	Aegypius monachus	x	✓(NT)	x	✓	Resident
Clamorous Reed Warbler	Acrocephalus stentoreus	x	x	x	✓	Breeding summer visitor
Collared Dove	Streptopelia decaocto	x	x	✓	✓	Resident
Common Crane	Grus grus	x	x	✓	x	Non-breeding winter visitor & passage migrant
Common Buzzard	Buteo buteo	x	x	x	✓	Non-breeding winter visitor & passage migrant
Common Kestrel	Falco tinnunculus	x	x	✓	✓	Resident
Common Pheasant	Phasianus colchicus	x	x	x	✓	Resident
Common Ringed Plover	Charadrius hiaticula	x	x	x	✓	Passage migrant
Common Starling	Sturnus vulgaris	x	x	x	✓	Resident
Common Swift	Apus apus	x	x	✓	✓	Breeding summer visitor & passage migrant

Corn Bunting	Emberiza calandra	x	x	x	✓	Resident
Crested Lark	Galerida cristata	x	x	✓	✓	Resident
Desert Finch	Rhodospiza obsoleta	x	x	x	✓	Resident
Eastern Imperial Eagle	Aquila heliaca	✓(VU)	✓(VU)	✓	x	Non-breeding winter visitor & possibly resident
Eastern Orphean Warbler	Curruca crassirostris	x	x	x	✓	Breeding summer visitor
Egyptian Nightjar	Caprimulgus aegyptius	x	x	✓		Breeding summer visitor
Egyptian Vulture	Neophron percnopterus	✓(EN)	✓(VU)	✓	✓	Breeding summer visitor & passage migrant
Eurasian Eagle Owl	Bubo bubo	x	x	x	✓	Resident
Eurasian Griffon Vulture	Gyps fulvus	x	✓(VU)	x	✓	Resident
Eurasian Sparrowhawk	Accipiter nisus	x	x	x	✓	Resident and passage migrant
Feral Pigeon	Columba livia forma domestica	x	x	✓	✓	Resident
Finsch's Wheatear	Oenanthe finschii	x	x	x	✓	Resident
Great White Egret	Ardea (alba) alba	x	x	✓	x	Resident and passage migrant
Green Sandpiper	Tringa ochropus	x	x	x	✓	Winter visitor and passage migrant
Grey Heron	Ardea cinerea	x	x	✓	x	Resident and passage migrant
Hen Harrier	Circus cyaneus	x	x	✓	✓	Non-breeding winter visitor
Hoopoe	Upupa epops	x	x	✓	✓	Resident and passage migrant
Indian Myna	Acridotheres tristis	x	x	✓	✓	Resident
Isabelline Wheatear	Oenanthe isabellina	x	x	✓	✓	Breeding summer visitor & passage migrant
Kingfisher	Alcedo atthis	x	x	x	✓	Resident
Laughing Dove	Spilopelia senegalensis	x	x	✓	✓	Resident
Lesser Whitethroat	Curruca curruca	x	x	x	✓	Breeding summer visitor

						& passage migrant
Little Bustard	Tetrax tetrax	x	ü(VU)	x	✓	Passage migrant
Little Owl	Athene noctua	x	x	✓	✓	Resident
Long-legged Buzzard	Buteo rufinus	x	x	✓	✓	Resident and passage migrant
Magpie	Pica pica	x	x	✓	✓	Resident
Marsh Harrier	Circus aeruginosus	x	x	✓	✓	Resident and passage migrant
Montagu's Harrier	Circus pygargus	x	x	x	✓	Passage migrant
Northern Goshawk	Accipiter gentilis	x	x	✓	x	Non-breeding winter visitor
Osprey	Pandion haliaetus	x	✓	x	✓	Passage migrant
Peregrine	Falco peregrinus	x	x	x	✓	Non-breeding winter visitor
Pied Stonechat	Saxicola caprata	x	x	✓	✓	Breeding summer visitor & passage migrant
Pied Wheatear	Oenanthe pleschanka	x	x	x	✓	Breeding summer visitor & passage migrant
Quail	Coturnix coturnix	x	x	x	✓	Breeding summer visitor & passage migrant
Raven	Corvus corax	x	x	✓	✓	Resident
Reed Bunting	Emberiza schoeniclus	x	x	✓	x	Resident
Rook	Corvus frugilegus	x	x	✓	✓	Resident
Sand Martin	Riparia riparia	x	x	x	✓	Passage migrant
Short-toed Eagle	Circaetus gallicus	x	x	x	✓	Passage migrant
Skylark	Alauda arvensis	x	x	x	✓	Resident and winter visitor
Siberian Stonechat	Saxicola maurus	x	x	✓	✓	Breeding summer visitor & passage migrant
Spanish Sparrow	Passer hispaniolensis	x	x	✓	✓	Resident
Tawny Pipit	Anthus campestris	x	x	✓	✓	Breeding summer visitor & passage migrant

Tree Pipit	Anthus trivialis	x	x	✓	✓	Passage migrant
Wallcreeper	Tichodroma muraria	x	x	✓	✓	Non-breeding winter visitor
Water Rail	Rallus aquaticus	x	x	x	✓	Resident
White Stork	Ciconia ciconia	x	✓(NT)	x	✓	Breeding summer visitor & passage migrant
Yellow Wagtail	Motacilla flava	x	x	✓	✓	Breeding summer visitor & passage migrant
Mammals						
Zaisan Mole Vole	Ellobius tancrei	x	x	✓	x	
Great Gerbil	Rhombomys opimus	x	x	✓	x	
Small Five-toed Jerboa	Allactaga elater	x	x	✓	x	
Libyan Jird	Meriones libycus	x	x	✓	x	
Yellow Ground Squirrel	Spermophilus fulvus	x	x	✓	x	
Long-eared Hedgehog	Hemiechinus auratus	x	x	✓	x	
Tolai Hare	Lepus tolai	x	x	✓	x	
Red Fox	Vulpes vulpes	x	x	✓	x	
Jackal	Canis aureus	x	x	?	✓	Reported by local residents at Solar PV
Wolf	Canis lupus	x	x	?	x	Reported by local residents
Common Pipistrelle	Pipistrellus pipistrellus	x	x	✓	x	
Brandt's Hedgehog	Paraechinus hypomelas	x	x	x	✓	
Reptiles						
Central Asian Tortoise	Testudo horsfieldii	✓(VU)	✓(VU)	✓	x	
Comb-toed Gecko	Crossobamon eversmanni	x	x	x	✓	
Bogdanov's Bent-toed Gecko	Tenuidactylus bogdanovi	x	x	✓	x	
Caspian Bent-toed Gecko	Tenuidactylus caspius	x	x	✓	x	
Turkestan Plate-tailed Gecko	Teratoscincus scincus	x	x	x	✓	
Steppe agama	Trapelus sanguinolentus	x	x	✓	✓	
Sogdian Toad-headed Agama	Phrynocephalus sogdianus	✓(EN)	x	x	✓	

Frilled Toad-headed Agama	Phrynocephalus mystaceus	x	x	x	✓
Black-ocellated Racerunner	Eremias nigrocellata	x	✓(VU)	✓	x
Rapid Racerunner	Eremias velox	x	x	✓	x
Reticulate Racerunner	Eremias grammica	x	x	x	✓
Sand Racerunner	Eremias scripta lasdini	x	x	x	✓
Striped Racerunner	Eremias lineolata	x	x	x	✓
Saw-scaled Viper	Echis carinatus	x	x	x	✓
Tatar Sand Boa	Eryx tataricus	x	NT	✓	✓
Sand Racer	Psammophis lineolatus	x	x	✓	x
Spotted Desert Racer	Platyceps karelinii	x	x	x	✓
Higher plants					
Shagalak	Salsola arbusculiformis	x	x	✓	✓
Hare Barley	Hordeum leporinum	x	x	✓	✓
Harmala	Peganum harmala	x	x	✓	✓
Camel thorn	Alhagi pseudoalhagi	x	x	✓	✓
A Cardueae	Cousinia bungeana	x	x	✓	x
A Cardueae spp	Cousinia spp.				
A perennial wormwood	Artemisia spp.	x	x	✓	x
Mortuk	Eremopyrum bonaepartis	x	x	✓	x
A Poppy	Papaver pavonium	x	x	✓	✓
Sagan	Girgensohnia oppositiflora	x	x	✓	x
Amaranthaceae family	Halocharis hispida	x	x	✓	x
Goose onion	Gagea sp.	x	x	✓	x
Wild chamomile	Microcephala lamellata	x	x	✓	✓
Stork's-bill	Erodium cicatarium	x	x	✓	✓
Bulbous Meadow-grass	Poa bulbosa	x	x	✓	✓
A Sedge	Carex stenophilloides	x	x	✓	x

Pea family	Trigonella geminiflora	x	x	✓	x
Seta (a Saltwort)	Salsola sp.	x	x	✓	x
Ischiolirion Tatar	Ixiolirion tataricum	x	x	✓	x
Prickly Caper	Capparis spinosa	x	x	✓	x
Bermuda Grass	Cynodon dactylon	x	x	✓	✓
Azhryk	Aeluropis littoralis	x	x	✓	✓
An Onion	Allium griffithianum	x	x	✓	x
An Onion	Allium opiophullum	x	x	✓	x
A Tamarix (shrub)	Tamarix laxa	x	x	✓	✓
A Tamarix shrub	Tamarix ramosissima	x	x	x	✓
A Tamarix shrub spp.	Tamarix spp.	x	x	x	✓
A Glasswort	Salicornia herbacea	x	x	✓	✓
Pea family	Chesneya tribuloides	x	✓	✓	x
Thorn- cushion	Polycnemum perenne	x	x	✓	x
A Poppy	Roemeria refracta	x	x	✓	✓
Machok (a Horned Poppy)	Glaucium elegans	x	x	✓	x
A Mint	Lallemantia royliana	x	x	✓	✓
A Labiatae	Ziziphora persica	x	x	✓	✓
Amaranthaceae family	Halostachys caspica	x	x	x	✓
Russian Box-thorn	Lycium ruthenicum	x	x	x	✓
Prickly Russian Thistle	Kali tragus	x	x	x	✓
A Wiregrass	Aristida spp.	x	x	x	✓
A shrub in the Pea family	Prosopis falctra	x	x	x	✓
A Bindweed	Convolvulus olgae	x	x	x	✓
A cormous perennial	Merendera robusta	x	x	x	✓
An Arum	Eminium albertii	x	x	x	✓
A grass	Eremopyrum bonapartis	x	x	x	✓

Siberian Lily	Ixiolirion tataricum	x	x	x	✓
Amaranthaceae family	Agrophylllum spp.	x	x	x	✓
Pea family	Hedysarum sp.	x	x	x	✓
Pea family	Astalegus sp.	x	x	x	✓
A Saltwort	Salsola praecox	x	x	x	✓
Poppy family	Hypecoum parviflorum	x	x	x	✓
A Leek	Allium oreophilum	x	x	x	✓

Appendix B Outline ESMMP

The mitigation measures for the construction and operation phases are summarised in Table 43 and Table 44, respectively and will be incorporated into the Project ESMS and CESMP/OESMP. Management measures for decommissioning will mirror that of construction and will be contained in the DESMP. The names of the individual management plans described are indicative and will be updated to maintain consistency with Masdar's ESMS.

For the avoidance of doubt, the following table and the measures listed in the ESIA should all be incorporated into the ESMS/ESMPs.

Table 51. Summary of the mitigation measures for the Construction Phase

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
Loss of vegetation cover and biodiversity	Implement robust management measures[135] to ensure good construction practice within the proposed project site. Employ an ecologist during construction to oversee implementation of the BAP. Initial site preparation and clearance to be undertaken outside of the bird breeding season, where possible. Storage of top 30cm of topsoil separately from subsoil. All of it should be stored on areas of modified habitat. A pre-construction survey should be completed for works undertaken in the breeding season to check for animals (reptiles and active bird nests) and, if species of conservation importance are identified, construction activities are to be programmed to avoid such features until they have been moved or there is a natural cessation of breeding effort. Construction vehicles must remain on the access roads and not drive in the un-cleared bush. All workers and contractors must use the designated parking areas on site and the designated tracks. Pre-construction surveys for species of importance. Topsoil to be used for restoration purposes. Natural regeneration is proposed. There will be an active management approach to ensure revegetation is successful but will be detailed in the BAP. Record sightings of Houbara bustard and Sociable lapwing within the vicinity of the site.	Biodiversity Action Plan	EPC EHS Manager HSE MANAGER ESHS Officer	Site Inspection Reports	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

[135] For example: NetRegs (2020). Guidance for Pollution Prevention (GPP). Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Provide identification guide to ensure site workers can identify the species. Areas to be cleared, precisely demarcated with vegetation clearing only in agreed areas. Clearing to commence on sign-off from ecologist and HSE MANAGER /ESHS Officer. Any areas outside of the footprint of the Project, that are cleared as a result of construction activities (compound, storage areas etc.) should be restored following the completion of construction phase. Fires will not be allowed under any circumstances. Cleared areas no longer required for construction activities should be restored by natural revegetation/reseeding using the existing seed bank contained in the topsoil.				
Disturbance, alteration & destruction of faunal and avifaunal habitats	Environmental toolbox talks prior to, and during, construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna. Areas which have to be cleared must be temporarily demarcated and fenced off to prevent access to animals. Daily inspections will be carried out on excavations to check for animals that might be trapped in the excavation. These individuals must be carefully moved to a safe area outside construction activities. Procedure will be implemented for removal of animals found within the construction area. Drivers operating in the area must be well briefed and must be aware of the dangers that vehicles pose to the local fauna, particularly slow moving species such as tortoise. Vehicle speed limits must be imposed and adhered to. A limit of 20kph is proposed but will be agreed with the EPC.	Biodiversity Action Plan	EPC EHS Manager	Site Inspection Reports	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Record all instances of collisions with project vehicles. Bird divertors installed on new overhead lines at sensitive locations. Tortoise holes cut in selected parts of the perimeter fence to enable free movement.				
Conflict between construction workers and fauna	The collection, harvesting or hunting of plants or animals is strictly prohibited. A 'no tolerance' policy will be adopted with respect to construction workers. Any person found guilty of poaching will be apprehended, immediately dismissed and referred to the appropriate authority.	Biodiversity Action Plan	EPC EHS Manager	Site Inspection Reports	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Risk of invasive flora species	Identification of potential invasive species and action taken to clear these species if they occur in or around areas designated for vegetation clearance prior to construction. Vehicles will be cleaned in a designated wash down area within the construction compound prior to entrance to site. Wash water will be directed to the surface water drainage system.	Biodiversity Action Plan	EPC EHS Manager	Site Inspection Reports	Mitigation work to be carried out as and when identified.
Surface water	Buffer distance of 25m applied to the seasonal watercourses. Routes of roads to be selected to avoid existing drainage channels or depressions where possible. Culverts or other drainage control features should be installed where crossings of drainage routes are unavoidable and to prevent ponding of surface water on the upstream side. Vehicles shall not be washed in nearby drainage canals. Washing will take place in designated wash down area within the construction compound.	Water and Wastewater Management Plan Traffic Management Plan	EPC EHS Manager	Site Inspection Reports Note: water quality samples are to e taken if there are signs of pollution.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Soil erosion	Run-off and erosion control features included in all civil designs by contractor.	Soil Erosion Management Plan	EPC EHS Manager	Site Inspection Reports	Prior to start of Construction.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Demarcate storage and staging areas and store all materials, equipment and vehicles in these areas to reduce soil damage. Vehicles confined to demarcated roadways. Where possible, establish native vegetation by natural revegetation in excavated areas immediately after final disturbance. Stockpiles of stripped topsoil with be used for revegetation as it contains native seeds. Salvage and store the top 30cm of topsoil and subsoil separately from areas excavated. On completion of earthworks, backfill material in same stratigraphic sequence i.e. subsoil first then topsoil. If narrowing access roads following construction, scarify compacted areas and establish native grasses. Once construction and road-building are complete, scarify all areas compacted by off-road vehicle / equipment movements and establish native vegetation. In the first instance monitor natural regeneration of vegetation. If unsuccessful an appropriate seed mix shall be used and will be applied at the start of the active growing season. Store all materials within designated areas of temporary storage facilities and provide supplies to clean-up of minor spills. Confine all vehicles and equipment to the roadway and, to extent possible, minimize activities during wet conditions. When activities must occur in wet conditions, control storm water by using fabric, straw bales or other measures to impede storm water flow and prevent erosion. When damage to wet soil occurs, repair once dry conditions return. Surface levelling should be carried out in the first instance.	Water and Wastewater Management Plan Biodiversity Action Plan			Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
Wastewater	Ensure temporary storage of wastewater at the site before disposal to a designated facility by a contracted waste handler. Where third party wastewater disposal & transport companies are to be utilized, the Company / EPC will ensure all required licenses / permits are in place and that they facilities are audited to ensure that they are fit for purpose. Prohibit illegal disposal of wastewater into the canals around the project site. Ensure regular inspection of wastewater management practices within the solar plant to check for compliance. Ensure there is proper and adequate sanitation facilities at the site during construction.	Water and Wastewater Management Plan Quantity of wastewater generated. Quantity of wastewater disposed by a licensed waste carrier	EPC EHS Manager Licensed waste carrier	Monthly ESHS reports prepared by EPC. Monthly HSE MANAGER audits of the MPs.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Sewage Effluent	The construction compound will have a local effluent collection and/ or treatment system. The contractor will design, build and operate these systems in accordance with Uzbek legislation and Good International Industry Practise. Effluent from domestic sewerage treatment shall meet the relevant standards acceptable to the Uzbek environmental authorities. Effluent will be stored in a septic tank or untreated storage tank and removed and disposed of periodically by a licenced contractor.	Water Management Plan	EPC EHS Manager HSE MANAGER	Monthly ESHS reports prepared by EPC. Monthly HSE MANAGER audits of the MPs.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified
Non-hazardous solid wastes	Develop a Waste MP with the aim of reducing waste generation on site, including workers accommodation as waste facilities in Uzbekistan do not meet GIIP. Train workers on solid waste management practices described in the Storage & Management of Waste MP and Lender Group requirements. Segregate all solid wastes at source. Re-use, re-cycle or reduce solid waste generation onsite to the extent possible.	Waste MP Quantity of solid waste generated. Quantity of solid waste correctly disposed to licensed disposal sites.	EPC EHS Manager Licensed waste carrier.	Monthly ESHS reports prepared by EPC Monthly HSE MANAGER audits of the MPs.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Dispose all construction wastes that cannot be recycled or reused to a licensed solid waste disposal site using a licensed refuse handler. Provide suitably sized facilities for proper handling, segregation and storage of wastes at designated points within the construction compound. Do not leave wastes on site at the end of the work. Provide adequate number of properly contained litter bins and containers properly marked with type of wastes. Strictly prohibit burning or dumping of any wastes at the site. Perform regular inspection of solid waste management practices onsite. Implement Duty of Care with respect to waste consignments, tracking where waste is transported to and disposed of.				
Hazardous materials / wastes	Provide suitably sized facilities for proper handling, segregation and storage of wastes at designated points within the construction compound. Hydrocarbons will not be stored on site. Refuelling will take place at designated area within the site compound. Refuelling area will be bunded 110% on an impermeable surface. For heavy equipment, a fuel tanker will be brought to site at a pre-defined time to refuel this equipment at site. Drip trays will be installed under refuelling points. Bunds to be located on impermeable surfaces with controlled drainage away from natural water courses. Bunds should be sufficient to contain 110% of the volume of liquids to be stored within. They should also be roofed to stop contamination of rainwater run-off.	Storage & Management of Wastes MP Storage and Management of Hazardous Materials MP. Pollution Incident Response Plan Quantity of Hazardous Waste generated. Quantity of Hazardous Waste disposed.	EPC EHS Manager Licensed waste carrier	Monthly ESHS reports prepared by EPC Monthly HSE MANAGER audits of the MPs.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Train site workers on proper hazardous waste management. Segregate site wastes by separating hazardous waste from non-hazardous waste. Ensure the hazardous waste collection containers are emptied at appropriate intervals to prevent overflow. Ensure that hazardous materials are stored in proper areas, where they cannot reach land in case of any spillage. Incorporate dripping pans at machinery, equipment and area prone to contamination by leakage of hazardous materials such as oil and fuel Regular maintenance of all equipment and machines used onsite so as to minimise leakage of hazardous materials Containers for storing hazardous waste, including used oil, should be stored securely, labelled and disposed in line with the governing regulations Undertake regular inspection of hazardous waste management practices onsite. Strictly prohibit illegal disposal of hazardous wastes onsite Store hazardous materials in designated areas secured with a fence. Implement Duty of Care with respect to waste consignments, tracking where waste is transported to and disposed of. Follow Uzbek Government requirements set out in the international Convention "The Control of Transboundary Movements of Hazardous Wastes and Their Disposal (IEA ID# 3042)				
Noise and vibration	Adopt and follow best practicable means to ensure that the quietest available plant and construction techniques are used.	Noise and Vibration MP.	EPC EHS Manager	Monthly ESHS reports prepared by EPC	Prior to start of Construction.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Where appropriate, micro-siting is to be undertaken to ensure construction noise impacts are minimised and equipment is located as far as possible from noise sensitive receptors (NSRs). NSRs include on-site accommodation. Routing of project construction traffic shall be through the main highway and short section of unmarked road to site. Restrict all construction activities to daytime during normal working hours Conduct construction activities within the maximum permitted noise levels Provide prior information to the community of any planned noisy activity that is likely to exceed the permitted noise levels (piling work) Strictly ensure the use of protective personal equipment at all times while on site and noise reduction techniques such as silencers and ear mufflers to employees Monthly monitoring of noise levels to comply with permitted maximum levels, including all vehicles and machineries on site.	Noise monitoring devices procured and installed on site Levels of noise and vibration produced at the site Number of Noise complaints received. Traffic MP			Monitoring carried out on a monthly basis or following a complaint. Mitigation work to be carried out as and when identified.
Archaeology and cultural heritage	A Chance Find Procedure is the key mitigation proposed and will be implemented during construction groundworks to reduce the likelihood of impacts occurring without adequate mitigation. The Developer or its contractors will not disturb any chance find further until an assessment by a competent professional is made and actions consistent with the requirements of IFC PS8 are identified. Cultural Heritage Awareness Training will be integrated into workforce site inductions and toolbox talks for all Project staff, contractors and subcontractors. In case of chance find, the work should be halted and the area protected and the matter reported	Chance Find Procedure. Number of recorded chance finds.	EPC EHS Manager Department of Culture.	Monthly ESHS reports prepared by EPC	Throughout the construction works.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	immediately to the Department of Culture for appropriate action.				
Visual and landscape	Full site restoration and revegetation carried out in accordance with the BAP. Remove in a timely manner all the construction machinery, equipment and vehicles that are not in use and keep them in specific locations within the Project site. Conduct demobilization audit prior to EPC leaving site to ensure that site conditions are acceptable for handover to the operations team.	Biodiversity Action Plan	EPC EHS Manager	Monthly ESHS reports prepared by EPC	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Occupational Health and Safety	Comply with 'governing regulations' and international best practise. Establish a permit to work system for all high-risk activities (i.e. hot works, confident space, working at high etc.) Train employees on the importance of occupational health and safety requirements and develop work instruction. Provide workers with appropriate personal protective clothing such as helmets, safety boots, gloves, dust masks, ear mufflers and overalls for use during construction. Strictly enforce the use of the Personal Protective Equipment to minimise the accidents. Provide regular medical checks for the workforce. Provide fully equipped First Aid Kit and sanitary facilities on site, including water for drinking and bathing, at all times. Provision and placement of appropriate fire extinguishers and training personnel on their use Put clear signage to restricted areas in Chinese, Uzbek, Russian and English languages. Prohibit unauthorised persons from entering the site through installation of a perimeter fence.	Occupational Health and Safety Plan. Covid 19 MP. Workers Accommodation MP IFC/ EBRD Guide for Workers Accommodation. Emergency Preparedness and Response Plan. Confirmation of the appointment of medical professional on site. PPE procured and being used by the workers Fire extinguishing facilities on site First aid kit on site Signage installed on site.	EPC EHS Manager HSE MANAGER	Monthly ESHS reports prepared by EPC Monthly HSE MANAGER audits of the MPs. Record of accidents and near misses Corrective Action Reports Grievance mechanism forms.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Undertake regular inspection to ensure compliance with OHSP. Report and investigate all incidences of accidents or near misses and keep proper records of the actions taken. Promote Covid-19 Awareness Provide appropriate traffic safety training to all drivers (employers and contractors) as part of their induction and on an on-going basis.				
Socio-economic – employment	Develop Local Recruitment and Employment Plan to encourage & maximize local workers, vulnerable persons and women in the workforce including retention and promotion. Communicate employment estimates, timeframes and skills requirements clearly to the community. Invest in skills training to enable greater employment of local population throughout Project life, for both construction and operations phases, to start as early as possible ensuring maximum employment during construction. Implement a local employment plan in consultation with the community and in a way that meets long term operational needs of the Project as well as the short-term construction needs, taking into account the relatively low skill base of the local population when it comes to solar power related jobs (see separate line item below). Investigate local sourcing and procurement opportunities to promote sustainable small business development. Invest in capacity building for small businesses to enable them to meet standards for procurement required by the company and to service the needs of indirect employees (through service industries).	Stakeholder Engagement Plan. Community Grievance Mechanism Local Recruitment & Employment Plan. Stakeholder engagement activities. Number of grievances recorded. Number of local workers hired. Minutes of stakeholder meetings. Skills training agreement with local vocation training centre. Agreement to provide support to local businesses	CLM / CLO	CGM log. Corrective Action Reports Number of local people employed on the Project. Training places provided and completed.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Work with local vocational training schools to develop curricula which will qualify local students to better meet the needs to the developing solar industry locally.				
Local hiring and workforce management	Develop a local employment plan including roles and responsibilities (there will be a need for HR, EPC hiring manager, CLM/CLO, EPC CLO and oversight by site management) Identification of job roles required and targets as appropriate. Use targets to measure the success of the local hiring plan. Identify level of interest in the project. This should include a list of names, skills, availability to start work. Identify training needs and verify the skills/qualifications. Community Liaison Officer to maintain a database of local workers expressing an interest in employment opportunities at the Project as per bullet point above, Pass this information on to the EPC contractor or responsible person. Periodically the EPC contractor will publish a list of required roles and will review the list of interested persons. The CLO should make sure this information is disclosed to the communities. The most suitable will be invited for interview and if suitable they will be offered jobs.	Local Recruitment & Employment Plan. Monthly workforce statistics.	CLM EPC EHS Manager HSE MANAGER	Monthly ESHS reports prepared by EPC Inspection reports CGM log. Number of local people employed on the Project. Training places provided and completed.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Socio-economic – population and land use	Implement measures to ensure access to local villages is not adversely affected by the fencing of the Project area. Such measures may include providing alternative routes to the village, which can be accessed by pedestrians as well as vehicles. Appropriate signage should be erected around the site. An access road which traverses the Solar PV Area from north to south will be maintained open during construction and operation, this includes	Community Health & Safety MP. Water Resource and Management Plan Confirmation of access arrangements. Minutes of stakeholder meetings.	CLO EPC EHS Manager HSE MANAGER	Inspection reports CGM log Corrective Action Reports	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	access to the graveyard which has been excluded from the site. Provide detailed and regular information to local community members about Project activity to mitigate community concerns as a result of misinformation. Consider scheduling construction activities to minimise the effects on local communities and farmers. For example, higher impact activities such as piling could be carried out outside of prayer times to reduce impacts on the nearby cemetery and prayer area. Prohibit non-local workers from entering the local communities. Operate a closed camp status for non-local residents. Consult with local stakeholders and users of the Mosque and graveyard to agree access during construction and operation including any adjustment to the working time of the mosque.				
Social Infrastructure	Provision of a dedicated medical professional to be employed by the Project. Investing in local social infrastructure through a community benefit program which will be developed in consolation with communities during the construction phase. Care will be taken to manage community expectations about social infrastructure.	Occupational Health and Safety Plan. Contract of employment for medical professional(s)	EPC EHS Manager HSE MANAGER	Confirmation of employment.	Prior to start of Construction. Monitoring carried out during weekly site inspections
Air Quality	Identify strategies to manage dust on the road during the execution of the Project. Provision of designated wash down area to spray and wash wheel spokes. tires and around the wheel opening of all vehicles entering and exiting the construction compound. Use of properly maintained vehicles and construction equipment with emission controls.	Traffic Safety MP Dust Suppression MP Vehicle inspection checks carried out Minutes of stakeholder meetings. CGM and WGM Grievances received.	EPC EHS Manager HSE MANAGER	Monthly ESHS reports prepared by EPC Inspection reports Record of traffic accidents and near misses CGM and WGM logs.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	If necessary, use water to dampen down on-site roads and excavations to reduce dust. Maximum speed limit of 20kph in place on site. Trucks carrying aggregates have covered loads when entering or leaving the site. Communicate project risk to local communities and address concerns accordingly. Monitor any complaints filed (via grievance mechanism) from local stakeholders as an additional tool to monitor dust management measures.				
Spread of Food and Water-borne Disease	Food stored and prepared in accordance with good hygiene standards and required by Uzbek and IFI standards. Establish food hygiene procedures including bacterial testing regimes to be established for camp kitchens and water supply. Where appropriate, support local public health campaigns against food and water borne diseases.	Water and Wastewater Management Plan Storage & Management of Waste MP OHS Plan CHS MP Adherence to International food standards (for example FAO/ WHO Codex Alimentarius) Agreements with relevant government /NGOs to support health campaigns Information disclosed as part of health campaigns	EPC EHS Manager HSE MANAGER	Monthly ESHS reports prepared by EPC Inspection reports WGM grievances log Corrective Action Reports	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Spread of Communicable Disease	Workers accommodation designed in compliance with the IFC/ EBRD Guide for Workers Accommodation and will not be based on site but rather use existing accommodation available. Health screening and quarantine if necessary, carried out in accordance with Covid-19 MP.	Covid 19 MP Workers Accommodation Plan OHS MP Provision of employee health screening.	EPC EHS Manager HSE MANAGER	Monthly ESHS reports prepared by EPC Monthly HSE MANAGER audits of the MPs. Corrective Action Reports	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Establishment of designated areas to handle quarantine cases. Establishment of a COVID19 management plan. Ensure health screening is being conducted for employees and contractors before contracting workers and prior to entrance to site. Temperature screening will be carried out on entrance to site each day. Random Covid-19 testing will be carried out throughout their employment/ contract. As part of health and safety induction for workers, provide awareness training on communicable disease prevention. Provide this training on an ongoing basis. Work in collaboration with an onsite medical team to ensure that such awareness and education training is appropriately provided to workers and contractors. Identify opportunities to support local public health campaigns that focus on prevention of communicable diseases.	Provision of health-related awareness and training to workforce Agreements with relevant government/ NGOs to support health campaigns		Heath related advertising and communication. Number of reported heath incidents.	
Increased Pressure on Health Services	Ensure that all Contractors are provided with adequate health care (for work related injuries and off the job-related health issues) that is independent of the local health care system. Liaise with local health professionals to identify ways that the Project can provide sustainable investments in the health care facilities used by their workers. Consider an agreement or contract with health care provider to provide investments in facilities used by workers	OHS Plan Provision of worker healthcare through dedicated Project professional.	EPC EHS Manager HSE MANAGER	Inspection reports Number of reported heath incidents.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Pressure on Water Resources	Ensure that workers and employees must not use water from the canals located east and west of the Project site. Ensure a system of penalties is put in place for non-compliance. Vehicles will not be washed in canals.	Water & Wastewater MP Grievances received Provision of water use and resource studies.	EPC EHS Manager HSE MANAGER	Inspection reports Corrective Action Reports Grievance mechanism forms.	Prior to start of Construction. Monitoring carried out during weekly site inspections.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
					Mitigation work to be carried out as and when identified.
Sale and Use of Drugs and Alcohol	Enforce and monitor the zero-alcohol and drugs tolerance policy, including current intoxication, for workers during working hours. Ensure random alcohol testing is conducted for workers entering and leaving the site. Design a system of penalties for anyone found with drugs or alcohol on site.	Workers Accommodation MP HR MP OHS Plan	EPC EHS Manager HSE MANAGER	Inspection reports Corrective Action Reports Test results. Disciplinary action taken.	Communicated prior to start of Construction. Monitoring carried out during weekly site inspections.
Safety of Local Community	Ensure that Project security is aware of the Project's goals to establish good relationships with local stakeholders; the grievance mechanism for communities to voice concerns; and receives human rights and cultural sensitivity training to ensure the respect and protection of the local community. Include policy requirements to prevent Gender Based Violence and Harassment (GBVH) of community members by the construction workforce. Appoint senior people in construction teams who are responsible for ensuring commitments regarding GBVH are implemented and to conduct a GBVH risk assessment and mitigate these risks appropriately inline with policy. These senior people should include women at senior decision-making levels. Include a safe and confidential reporting mechanism from local communities as part of the grievance process. Provide periodic training on GBVH to all of the workforce and ensure to vet all contractors with based on their performance of managing GBVH.	Community Health & Safety MP Provision of information through the SEP and grievance mechanism Trainings provided on GBVH Senior representatives for managing GBVH appointed	CLO EPC EHS Manager HSE MANAGER	Monthly HSE MANAGER audits of the MPs. Inspection reports Corrective Action Reports Grievance mechanism forms.	Communicated prior to start of Construction. Monitoring carried out during weekly site inspections.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
Site security	Develop a Security MP / Code of Conduct for site security personnel which will be in line with the requirements of PS2, PS4 and the Voluntary Principles of Security & Human Rights. Security provided by private security firm only, not the home guard. Firearms are prohibited on site. Fence the entire solar plant to restrict entrance to the site. Inspect the fence around the facility regularly and seal all loopholes. Ensure adequate lighting within and around the solar plant. Regularly check and maintain security lights at the site. Train the onsite guards to adequately handle trespass incidents Ensure that the security staff act in compliance with relevant Uzbek laws; Ensure that robust background checks are carried out staff to make sure they have not been implicated in past abuses; Implement a Code of Conduct for security personnel; Introduce head of security personnel to neighbouring communities and outline the necessary safety precautions that will need to be put in place to ensure both the safety of the Project and safety of local communities; Community safety meetings should be organised with all potentially affected groups and be	Security and site access MP Provision of code of conduct for security personnel. Results of background checks for security staff. Minutes of stakeholder meetings. CGM and WGM Grievances received.	EPC EHS Manager Security Contractor HSE MANAGER	Monthly ESHS reports prepared by EPC Monthly HSE MANAGER audits of the MPs. Inspection reports CGM and WGM logs.	Communicated prior to start of Construction. Monitoring carried out during weekly site inspections

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	conducted in advance of construction activities; and Ensure that all potentially affected stakeholders know how to contact the company and to file grievances or concerns about security arrangements.				
Emergency response	Work with local emergency responders to at minimum: (i) communicate ERP; (ii) depending on level of risk from emergency events build local capacity to ensure appropriate local response in case of emergency. Communicate potential risks and ERP to those potentially most affected by emergency events. Provide safety information to local community via the SEP. Emergency drills must be completed.	OHS Plan Emergency Management and Response Minutes of community meetings Findings of Emergency Drills CGM and WGM Grievances received.	Masdar EPC EHS Manager Security Contractor HSE MANAGER	Monthly ESHS reports prepared by EPC Monthly HSE MANAGER audits of the MPs. Emergency Drills	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.
Traffic management	The Traffic Safety Management Plan must aim to reduce risks to drivers, communities along the transport route, as well as components being transported. The TMP is to include (amongst others) a detailed site access route; stopovers, speed controls; measures for ensuring well-maintained vehicles and access roads; procedures for ensuring appropriate training programmes and licences are in place for all drivers; and detail on sensitive receptors along the transport route. Provide appropriate traffic safety training to all drivers (employees and contractors) as part of their induction and on an ongoing basis. As part of pre-construction engagement activities, ensure that traffic safety and "rules of the road" are discussed with local communities. Discuss and address community concerns. Special sessions may be required for particularly vulnerable groups such as children. At minimum communicate type, frequency and traffic risks before heavy traffic begins for the construction	Traffic Safety MP Number of road safety briefings provided. Number of road safety complaints received. Number of driving incidents including speed violations.	EPC EHS Manager Security Contractor HSE MANAGER	Monthly ESHS reports prepared by EPC Monthly HSE MANAGER audits of the MPs. Inspection reports Record of accidents and near misses WGM and CGM Logs.	Prior to start of Construction. Monitoring carried out during weekly site inspections. Mitigation work to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	phase. All discussions and training sessions are to be made available in language that the workers can understand. Construction traffic through community areas will not be permitted with the exception of public meetings and stakeholder engagement activities.				

Table 52. Summary of the mitigation measures for the Operation Phase

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
Biodiversity	Confine all vehicles to roadways. Road condition monitored regularly, and damaged and rutted roads repaired rather than bypassing damaged sections. Monitoring of erosion controls and repair as needed. Re-stabilise existing eroded tracks with restoration of vegetation cover as required. Hunting prohibited on site, particularly in relation to Houbara bustard. During routine maintenance any invasive flora species should be identified and removed. Cutting and poisoning of saplings is an effective control measure. Record bird collisions with the panels and overhead lines. Monitor and maintain bird flight diverters on OHTL throughout operational phase. Implementation of mitigation measures for Central Asian Tortoise (TBC) as set out in the BAP. Record sightings of Sociable lapwing and Houbara bustard in the vicinity of the Solar Park, Identify a recently excavated area on site and manage it to understand rate and success of natural revegetation. Active management approaches shall be implemented if necessary. Routine inspections will record any bird collisions and fatalities on site in line with IFC guidance: Bird rescue protocol and monitoring at PV solar sites	Biodiversity Action Plan Annual audits Number of bird collisions with OHTL Tortoise population Success level of vegetation restoration. Level of plant cover. Presence of indicator species.	Project Developer	Audit Reports	Plan developed prior to start of Operation. Monitoring carried out during detailed monthly audits. Mitigation to be carried out as and when identified.
Liquid wastes	Develop a Water Management Plan for operations. Train employees on the importance of proper liquid waste management and water resource management. Reduce, reuse or re-cycle all liquid waste generated onsite to the extent possible. Dispose all liquid wastes that cannot be recycled or reused to liquid waste disposal facilities a licensed transporter.	Water Management Plan Pollution Incident and Response Plan Quantity of liquid waste generated Quantity of liquid waste correctly disposed to disposal sites	Project Developer Licensed hazardous waste transporter	Water Management Plan and Inventory Inspection reports Audit Reports	Plan developed prior to start of Operation. Monitoring carried out during detailed monthly audits. Mitigation to be carried out as

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Prohibit illegal disposal of wastewater into waste resources (canals or groundwater). Conduct inspection of wastewater management practices to check for compliance Emphasise on proper sanitation during operation phase of the project.	Number of Waste storage facilities the plant Number of Sanitation facilities on at the plant Number of Audits completed			and when identified.
Solid Wastes	Develop a Waste Management Plan for operations. This will establish the Chain of Custody system to be implemented. Train employees on the importance of proper solid waste management Reduce, reuse or re-cycle all solid waste generated to the extent possible Dispose all solid wastes that cannot be recycled or reused to solid waste disposal sites using a licensed refuse handler. Disposal sites shall be appropriately licensed and meet the general requirements of IFC PS. Maintain proper records of solid wastes to know the quantity of wastes generated on site Provide adequate waste bins and containers at specific places and ensure they are properly marked with type of wastes Perform regular inspection of waste management practices onsite. Wastes will be stored in a designated storage area within the substation area to facilitate collection of the wastes by third party waste collector.	Implementation of Waste Management Plan. Quantity of solid waste generated Number of solid waste storage facilities at the plant Quantity of solid waste correctly disposed to disposal sites Number of completed inspection missions Annual audits	Project Developer Licensed hazardous waste transporter	Solid waste management Plan and inventory Inspection Reports Audit Reports	Plan developed prior to start of Operation. Monitoring carried out during detailed monthly audits. Mitigation to be carried out as and when identified.
Water availability	A full Water Management Plan will be developed prior to the commencement of operations. The water source and requirement needed for cleaning of panels will be included in the Water MP	Water Management Plan Operational water availability / resource use assessment.	Project Developer	Inspection reports.	Plan developed prior to start of Operation. Monitoring carried out during detailed monthly audits. Mitigation to be carried out as

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
					and when identified.
Soil erosion/compaction	Confine all vehicles to roadways. Monitor road condition regularly; then repair damaged and rutted roads rather than bypassing damaged sections. Monitor erosion controls and repair as needed. Where possible, maintain any existing grass cover on berms and ditches. Prohibit use of vehicles and equipment off prepared roads. Re-stabilize existing eroded tracks and restore grass cover as needed.	Biodiversity Action Plan Number of completed inspections, Annual audits.	Project Developer	Inspection reports.	Plan developed prior to start of Operation. Monitoring carried out during detailed monthly audits. Mitigation to be carried out as and when identified.
Visual Impacts	Implement site rehabilitation and landscaping measures to restore the site. This should be implemented in the first available active growing season following the completion of construction. Ensure proper storage, regular collection and disposal of waste streams generated. Carry out the facility inspection work on regular basis.	Biodiversity Action Plan Waste management plan developed and implemented Site inspection missions completed Annual audits	Project Developer.	Inspection Reports Grievance Reports Audit Reports	Plan developed prior to start of Operation. Monitoring carried out during detailed monthly audits. Mitigation to be carried out as and when identified.
Hazardous Materials / Wastes	Develop and implement a Waste Management Plan. Train employees on Hazardous waste management Segregate waste by separating hazardous waste from non-hazardous waste. Establish a designated storage area for fuels / chemicals with an impervious base and impermeable bund walls and protected from precipitation. Capacity must be 100% of the full volume to be stored within a bund and secured area. Containers for storing hazardous materials / waste (including used oil) should be stored in the designated, secured with a fence. All containers are to be labelled correctly.	Waste Management Plan developed and implemented Number of trained Workers on Hazardous Waste Management Amount of Hazardous Waste Segregated Quantity of accidental hazard spillage Quantity of hazardous waste correctly disposed	Project Developer Licensed hazardous waste transporter	Inspection Reports Hazardous Waste Management Plan and Inventory Audit Reports	Plan developed prior to start of Operation. Monitoring carried out during detailed monthly audits. Mitigation to be carried out as and when identified.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
	Ensure the hazardous waste collection containers are emptied at appropriate intervals to prevent overflow. Prohibit illegal disposal of hazardous wastes on the solar plant during solar plant maintenance exercise. Undertake regular inspection of hazardous waste management practices onsite. Vehicles will not be refuelled on site but at the nearby filling station. Provision for chemical, oil and hazardous spills kits to be located in strategic locations to immediate access and to control the spill and contain any hazards.	Number of completed inspection missions Annual Audits			
Occupational Health and Safety	Develop and implement an O&M ESHS MP for operations. Train new employees on the importance of occupational health and safety Ensure compliance with the governing regulations Maintain the fence around the entire solar park to prohibit unauthorized persons from accessing the site Provide workers with appropriate personal protective clothing such as helmets, safety boots, gloves, dust masks (if required) and overalls. Strictly enforce the use of the Personal Protective Equipment to minimise the accidents during decommissioning Regular medical checks including screening for Covid-19 Provide fully equipped First Aid Kit and sanitary facilities on site, including water for drinking and bathing Put clear signage to restricted areas in Uzbek, Chinese and English language to reduce risk of accidents Undertake regular inspection of the plant Promote Covid-19 Awareness in languages that the workers understand.	O&M ESHS MP developed and implemented Number of employees trained on occupational health and safety PPE procured and being used by the employees Fire extinguishing facilities at the plant First aid kit on site Signage installed at the plant Number of inspection missions competed Annual Audits	Project Developer	Inspection reports Record of accidents and near misses Corrective Action Reports	Plan developed prior to start of Operation. Monitoring carried out during weekly and monthly audits. Mitigation to be carried out as and when identified.
Noise and Vibration	Carry out an operational noise survey in the event of complaints being received.	Levels of noise and vibration produced at the site Number of Noise complaints received	Project Developer	Inspections Project Grievance Mechanism	In the event of a complaint being received.

Impact	Mitigation Measures	MP Reference and KPI (if appropriate)	Responsibility	Monitoring Means	Frequency
		Number of inspection missions completed			
Socio-economic	Continuing stakeholder engagement in accordance with the SEP and manage expectations in terms of the number of employment opportunities generated during operations. Continued implementation of the Local Recruitment & Employment Plan in consultation with the local community. Continued implementation of community grievance mechanism. Continued implementation and compliance with O&M ESHS MP. Development of Security Management Plan and use of private security personnel. National Guard will not be used to provide security.	Stakeholder Engagement Plan Stakeholder engagement activities. Number of grievances recorded. Number of local workers hired. Security Management Plan	Contractor Project Developer	Inspection reports Community consultation. Project Grievance Mechanism	Monitoring carried out during detailed monthly audits. .

Appendix C Example Key Performance Indicators

The Project's E&S targets will be assessed by the following key performance indicators which were set according to the national standards and international best practice (adhere to more stringent standards) for the project during construction and operational phases. The following table shows the elements that are proposed to be monitored during the life of the Project.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Air Quality					
Ambient air quality	Fugitive dust and particles (SPM, PM10)	Construction Decommissioning	PM10: 50 µg/m3 (24-hours);	In the event of a valid complaint being received.	Independent 3rd party consultant
Ambient air quality	No visible dust outside the site boundary	Construction Decommissioning	Visual observation	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of dust suppression	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Ambient air quality	Pollution Prevention and Control Plan	Construction Decommissioning	Confirmation of compliance with measures specified in the Pollution Prevention and Control Plan as it relates to air quality. Refer to the Pollution Prevention and Control Plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of prevention measures to reduce air quality impacts.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Vehicle emissions	Traffic management plan	Construction Decommissioning	Confirmation of compliance with measures specified in the Traffic management plan as it relates to air quality. Refer to the Traffic management plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of prevention measures to reduce air quality impacts.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Vehicle emissions	Vehicle inspection checks	Construction Decommissioning	Confirmation that checks have been carried out and that vehicles have passed.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of prevention measures to reduce air quality impacts.	Monthly checks: EPC and ROLE TBC.
Ambient air quality	Complaints relating to dust and air quality	Construction Decommissioning	Minutes of community meetings Grievances received	During weekly checks and monthly detailed audit	Weekly checklist: CLO, EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Noise and vibration					
Ambient noise and vibration level	Observed sound levels in L_{Aeq} dBA for day and night time against nature and recipient. Limits apply at the boundary of closest residential properties.	Construction Operation Decommission	Construction limits: 70 dBA Operation limits: Daytime: 55 dBA Night-time: 45 dBA	Noise measurements to be taken in the event of a valid complaint being received.	Independent 3rd party consultant
Noise and vibration	Noise monitoring devices procured and installed on site	Construction Operation Decommissioning	Number and type of noise monitoring devices	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Noise and vibration	Number of PPE procured and being used by workers	Construction Operation Decommissioning	Visual inspection of PPE use on site	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Noise and vibration	Number of Noise complaints received	Construction Operation Decommissioning	Review of grievance log	During weekly checks and monthly detailed audit	Weekly checklist: CLO, EPC and ROLE TBC Monthly detailed audit: Masdar

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
					E&S Manager.
Hydrology and Water Quality					
Surface and groundwater quality	Level of pollutants in surface and groundwater	Prior to start of Construction Prior to Operation Decommissioning	pH (SI) Conductivity (µS/cm) TDS (mg/L) TSS (mg/L) DO (mg/L) ORP Metals (mg/L) E-coli (cfu) Hydrocarbons (mg/L)	Sampling prior to start of construction and following completion of construction. Further sampling to be taken pre and post decommissioning. Additional sampling should be carried out in the event of a valid complaint being received.	EPC and ROLE TBC. Lab analysis carried out by suitable qualified laboratory.
Loss of habitat and disturbance to waterbodies.	Water Resource and Management Plan	Construction Decommissioning	Confirmation of compliance with measures specified in the Water Resource and Management Plan. Refer to the Water Resource and Management Plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of flora to maintain both biodiversity and to protect against erosion.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Loss of habitat and disturbance to waterbodies.	Biodiversity Action Plan	Construction Decommissioning	Confirmation of compliance with measures specified in the Biodiversity Action Plan as it relates to waterbodies. Refer to the Biodiversity Action Plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of waterbodies.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.
Alteration of surface water flow	Culverts or other drainage control measures constructed.	Construction Operation Decommissioning	Confirmation of number of culverts or other drainage control measures constructed and condition of such culverts.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of waterbodies.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Alteration of surface water flow	Water Resource and Management Plan	Construction Operation Decommissioning	Confirmation of compliance with measures specified in the Water Resource and Management Plan as it relates to waterbodies. Refer to the Water Resource and Management Plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of waterbodies.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.
Alteration of surface water flow	Drainage system design	Pre-Construction. Construction Operation Decommissioning	Confirmation of suitability of drainage system design.	Prior to sign off on detailed design. Performance of drainage system verified during weekly and monthly audits.	Pre-construction: Masdar Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Alteration of surface water flow	Flood risk assessment.	Construction Operation Decommissioning	Confirmation that measures specified in the FRA have been implemented on site.	During monthly detailed audit.	Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.
Untreated Sewage Effluent	Water Resource and Management Plan	Construction Operation Decommissioning	Confirmation of compliance with measures specified in the Water Resource and Management Plan as it relates to sewage effluent. Refer to the Water Resource and Management Plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of waterbodies.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Untreated Sewage Effluent	Provision of waste management plan	Construction Operation Decommissioning	Confirmation of compliance with measures specified in the waste management plan as it relates to sewage effluent. Refer to the waste management plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of waterbodies.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Untreated Sewage Effluent	Information disclosed as part of health campaigns	Construction Operation Decommissioning	Review of health related information disclosure and awareness programs being undertaken.	During monthly detailed audit	Monthly detailed audit: Masdar
Geology and Soils					
Alteration of surface water flow	Civil engineering design	Pre-Construction. Construction Operation Decommissioning	Confirmation of suitability of civil engineering design.	Prior to sign off on civil engineering design. Performance of civils design verified during weekly and monthly audits.	Pre-construction: Masdar Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Soil quality and erosion	Erosion rate observation	Construction Operation Decommissioning	Visual observation	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of managing erosion	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager
Biodiversity					
Flora protection	Destruction rate observation and revegetation success.	Construction Operation Decommissioning	Visual observation	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of protection of flora to maintain both biodiversity and to protect against erosion.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.
Flora protection	Destruction rate observation and signs of erosion.	Construction Operation Decommissioning	Confirmation of the use of designated roads and parking areas	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of flora to maintain both biodiversity and to protect against erosion.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Flora protection	Preparation and implementation of Biodiversity Action Plan.	Construction Operation Decommissioning	Confirmation of compliance with measures specified in the Biodiversity Action Plan. Refer to the Biodiversity Action Plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance in terms of the protection of flora to maintain both biodiversity and to protect against erosion.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.
Conflict between construction workers and fauna	No evidence of workforce damaging or hunting/collecting flora and fauna	Construction Operation Decommissioning	Visual observation and monitoring of grievance mechanism	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of protection of flora and fauna and prohibition of hunting and collecting species.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.
Risk of invasive flora species	No sign of spread of invasive species.	Construction Operation Decommissioning	Visual observation	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of protection of flora to maintain both biodiversity and to protect against erosion.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Risk of invasive flora species	Preparation and implementation of Biodiversity Action Plan.	Construction Operation Decommissioning	Confirmation of compliance with measures specified in the Biodiversity Action Plan. Refer to the Biodiversity Action Plan for further details.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of protection of flora to maintain both biodiversity and to protect against erosion.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager with support from 3rd party ecology as required.
Occupational Health and Safety					
Occupational Health and Safety	Occupational Health and Safety Plan developed and implemented	Construction Operation Decommissioning	Compliance with the measures specified in the OHS plan	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of OHS.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager and EPC HSE Manager.
Occupational Health and Safety	Develop and implement Emergency Preparedness and Response Plan.	Construction Operation Decommissioning	Compliance with the measures specified in the Emergency Preparedness and Response Plan	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of OHS.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager and EPC HSE Manager.
Occupational Health and Safety	Workers trained on occupational health and safety	Construction Operation Decommissioning	Workers trained on occupational health and safety and confirmation that number meets the requirement for the total workforce on site	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of OHS.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager and EPC HSE Manager.
Available of suitable PPE	PPE procured and being used by the workers	Construction Operation Decommissioning	Visual inspection and review of the number of H&S incidents, near-misses or accidents recorded.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
				OHS.	E&S Manager and EPC HSE Manager.
Availability of fire fighting facilities	Fire extinguishing facilities on site	Construction Operation Decommissioning	Visual inspection and review of the number, availability and condition of facilities.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of OHS.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager and EPC HSE Manager.
Availability of first aid kit and qualified first aiders	Qualified first aid professionals on site and first aid kit on site	Construction Operation Decommissioning	Visual inspection and review of the number, availability and condition of first aid kits. Confirmation of a medical professional on site.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of OHS.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Occupational Health and Safety	Signage installed on site	Construction Operation Decommissioning	Confirmation of appropriate signage on site particularly at meeting areas or where work will be undertaken. Number of H&S incidents, near-misses or accidents recorded.	During weekly checks and monthly detailed audit Daily toolbox talks should emphasise the importance of OHS.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Waste					
Solid and Liquid wastes	Pollution Prevention and Control Plan	Construction Operation Decommissioning	Confirmation of implementation of the Pollution Prevention and Control Plan	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Solid and Liquid wastes	Water Resource and Management Plan	Construction Operation	Confirmation of implementation of the Water	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
		Decommissioning	Resource and Management Plan		Monthly detailed audit: Masdar E&S Manager.
Liquid wastes	Quantity and quality of liquid waste generated Number of Sanitation facilities on site	Construction Operation Decommissioning	Confirmation of Quantity and quality of liquid waste generated. Confirmation that waste water has been collected and disposed of at a licensed facility or appropriately treated on site in the case of sewage.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Eppert.
Liquid wastes	Number of Sanitation facilities on site	Construction Operation Decommissioning	Confirmation of number of sanitation facilities on site and confirmation that it meets the needs of the workforce.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Solid wastes	Quantity of solid waste generated and correctly disposed to licensed disposal sites.	Construction Operation Decommissioning.	Confirmation of Quantity and quality of liquid waste generated. Confirmation of disposal by licensed solid waste transporter.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Solid wastes	Solid waste storage facilities on site.	Construction Operation Decommissioning.	Confirmation of number of waste facilities on site and confirmation that there has been appropriate segregation and storage.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Hazardous materials / wastes	Hazardous Waste Management training	Construction Operation Decommissioning.	Number of Trained Workers on Hazardous Waste Management	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
					E&S Manager.
Hazardous materials / wastes	Amount of Hazardous Waste Segregated	Construction Operation Decommissioning.	Confirmation of amount of hazardous waste generated.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Hazardous materials / wastes	Quantity of accidental hazard spillage	Construction Operation Decommissioning.	Confirmation of number of spillages of hazardous wastes.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Security					
Project site safety and security	Security Management Plan developed and implemented	Construction Operation Decommissioning.	Confirmation of implementation of the Security Management Plan	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Project site safety and security	Number of Security personnel employed	Construction Operation Decommissioning.	• Confirmation of implementation of the Water Resource and Management Plan	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Project site safety and security	Site Fence Trained workers on site security	Construction Operation Decommissioning.	Visual inspection of the condition of the site perimeter	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit:

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
			fence and evidence of damage.		Masdar E&S Manager.
Project site safety and security	Trained workers on site security	Construction Operation Decommissioning.	Review of number of trained workers on site security	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Project site safety and security	Provision of code of conduct for security personnel.	Construction Operation Decommissioning.	Confirmation that a code of conduct is in place and that all security personnel have sign up to it.	Prior to the appointment of security personnel	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Project site safety and security	Results of background checks for security staff.	Construction Operation Decommissioning.	Review of Results of background checks for security staff.	Prior to the appointment of security personnel	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Project site safety and security	Positive view of the security personnel by local community meetings	Construction Operation Decommissioning.	Minutes of community meetings Confirmation of provision of information through the SEP and grievance mechanism	During weekly checks and monthly detailed audit	Weekly checklist: CLO, EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Community Health and Safety					
Safety of Local Community	Community H&S Plan	Construction Operation Decommissioning.	Confirmation of implementation of the Community H&S Plan See separate CHS Plan for further details.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Safety of Local Community	Provision of information through the SEP and grievance mechanism	Construction Operation Decommissioning.	Review of information provided to communities and review of grievance log.	During weekly checks and monthly detailed audit	Weekly checklist: CLO, EPC and ROLE TBC Monthly detailed audit: Masdar

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
					E&S Manager.
Archaeology and Cultural Heritage					
Archaeology and cultural heritage	Chance Find Procedure	Construction	Confirmation of implementation of the Chance find procedure and review of reports produced	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Archaeology and cultural heritage	Number of recorded chance finds	Construction	Number and type of chance finds	During weekly checks and monthly detailed audit for the initial site preparation and topsoil stripping work.	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Visual and Landscape					
Visual and landscape	Site rehabilitation and landscaping	Operation Decommissioning.	Visual inspection of success of site rehabilitation and landscaping	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Visual and landscape	General site condition	Construction Operation Decommissioning.	Visual inspection of site condition and presence of litter particularly on the perimeter fence.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Socio-economic					
Socio-economic – population and economy	Stakeholder Engagement Plan and grievance mechanism	Construction Operation Decommissioning.	Confirmation of implementation of the Stakeholder Engagement Plan and grievance mechanism	During weekly checks and monthly detailed audit	Weekly checklist: CLO Monthly detailed audit: Masdar E&S Manager.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
			Review of Stakeholder engagement activities. Number of grievances recorded.		
Socio-economic – population and economy	Skills training agreement with local vocation training centre.	Construction Operation Decommissioning.	Confirmation of training places provided and completed.	During weekly checks and monthly detailed audit	Weekly checklist: CLO Monthly detailed audit: Masdar E&S Manager.
Local hiring and workforce management	Local employment plan	Construction Operation Decommissioning.	Confirmation of the implementation of a Local employment plan Monthly audit results showing workforce statistics	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Socio-economic – population and economy	Adherence to GIIP with respect to construction works.	Construction	Visual inspection of construction works	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Socio-economic – population and economy	Access arrangements for local residents.	Construction Operation Decommissioning.	Review of grievance log	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Spread of Food and Water-borne Disease	Agreements with relevant government/NGOs to support health campaigns	Construction Operation Decommissioning.	Agreements with relevant government/NGOs to support health campaigns	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Spread of Food and Water-borne Disease	Information disclosed as part of health campaigns	Construction Operation Decommissioning.	Heath related advertising and communication.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
					E&S Manager.
Spread of Communicable Disease	Provision of employee health screening.	Construction Operation Decommissioning.	Confirmation of health screening. Number of reported heath incidents.	During monthly detailed audit	Monthly detailed audit: Masdar E&S Manager.
Spread of Communicable Disease	Provision of H&S induction focus on heath matters.	Construction Operation Decommissioning.	Confirmation that all workers have completed the health related induction.	During monthly detailed audit	Monthly detailed audit: Masdar E&S Manager.
Spread of Communicable Disease	Provision of health related awareness and training to workforce	Construction Operation Decommissioning.	Review of heath related advertising and communication. Number of reported heath incidents.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Increased Pressure on Health Services	Provision of worker health care through dedicated Project professional	Construction Operation Decommissioning.	Agreement or contract with health care provider. Confirmation of presence of health care professional on site.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Increased Pressure on Health Services	Investments in facilities used by workers	Construction Operation Decommissioning.	Agreement or contract with health care provider to provide investment in facilities.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Pressure on Water Resources	Provision of worker code of conduct	Construction Operation Decommissioning.	Review of signed worker code of conduct. Review of grievance log. Visual inspection confirming availability of bottled water for workforce.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.

Environmental component	Key performance indicators	Project phase	Parameter to be measured	Sampling frequency	Responsibility
Sale and Use of Alcohol	Development of zero-alcohol policy	Construction Operation Decommissioning.	Review of reported incidents and results of failed alcohol tests	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Traffic and Transportation					
Traffic Management	Traffic Management Plan	Construction Operation Decommissioning.	Confirmation of implementation of the Traffic Management Plan. Review of grievance log.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Traffic incidents	Advanced driver training.	Construction Operation Decommissioning.	Number of drivers that received advanced driver training.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Traffic incidents	Road safety briefings provided.	Construction Operation Decommissioning.	Number of road safety briefings provided.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.
Traffic incidents	Reported driving incidents including speed violations.	Construction Operation Decommissioning.	Number of driving incidents including speed violations.	During weekly checks and monthly detailed audit	Weekly checklist: EPC and ROLE TBC Monthly detailed audit: Masdar E&S Manager.

Appendix D Turnstone Ecology CHA Report

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