Initial Environmental and Social Examination Report

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Uzbekistan: Samarkand Solar Power Project
Part 1: Main Report

Prepared by AECOM Limited for the Asian Development Bank.

Samarkand Solar PV Project

Environmental and Social Impact Assessment

13 January 2023

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Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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Abbreviations and 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 200 MWac solar PV facility in the Kattakurgan district, Samarkand region of the Republic of Uzbekistan, complete with 220/110/10 kV substation and a 4.5 km transmission line to the Ishtihan 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

The Government of Uzbekistan aims to develop up to 12 gigawatts (GW) of solar and wind power by 2030 through the development of privately financed and operated renewable energy projects. Scaling Solar is a World Bank Group program that assists governments to procure and develop large solar projects with private financing. The first solar photovoltaic (PV) plant, with 100 megawatt (MW) capacity, developed through Scaling Solar Program, is being constructed in Navoi region at the time of publication of this report.

World Bank Group's Scaling Solar Uzbekistan Round 2 program aims to add over 400 MW of clean and renewable PV energy to the country's energy mix. As part of this round, two sites — in Samarkand and Jizzakh regions have been identified for development.

This report covers the development of a 220 MWac solar PV project in Kattakurgan District, Samarkand region of Uzbekistan, referred to as "the Project", location of which is shown in Figure 1-1. The project site is approximately 20 km from Kattakurgan and approximately 50 km from Samarkand. The Project site area is 426 ha.

The Project will also comprise a 4.5 km overhead transmission line (OHL) from the on-site substation to the existing Ishtihan substation.

Table 1-1. Key Project characteristics

LOCATION	Kattakurgan District, Samarkand region, Republic of Uzbekistan
INSTALLED CAPACITY	220 MWac
SOLAR PV SITE AREA	426 ha
OVERHEAD GRID CONNECTION LINE	4.5 km 220 kV Steel lattice towers
NATIONAL GRID SUBSTATION	Ishtihan

Table 1-2. Emissions Reduction

PROJECT ANNUAL ELECTRICITY GENERATION (KWH)	594,209,000
NUMBER OF HOUSES POWERED BY THE PROJECT	264,093
EMISSION REDUCTIONS OF CARBON DIOXIDE ANNUALLY (TONNES/YR)	237,684

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

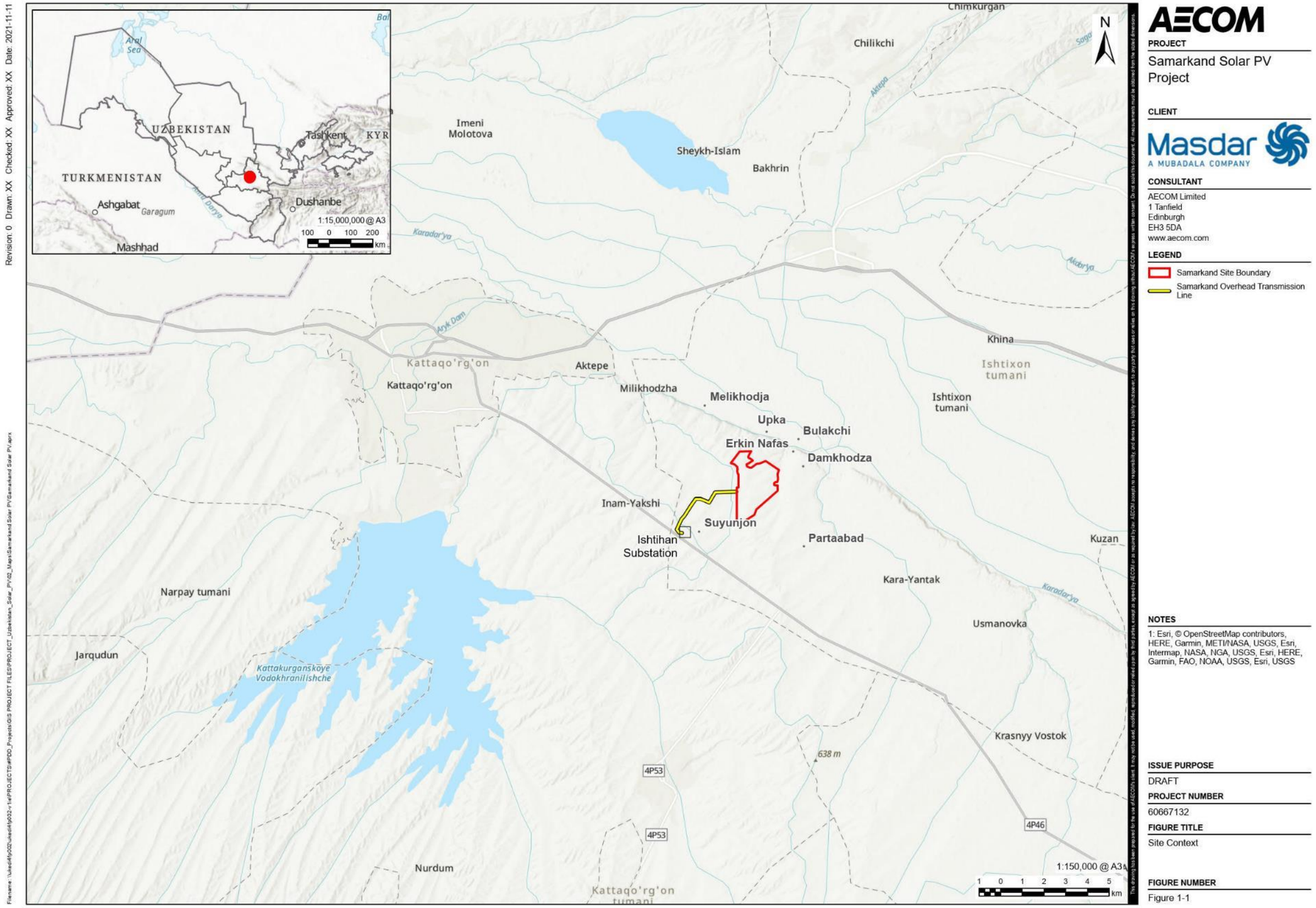

Figure 1-1. Site context

1.2 Purpose of This Report

The purpose of this ESIA Report is to:

- Document legislative requirements of Uzbekistan for this type of project
- Describe the methodology and approach to be used in assessing impacts
- Identify the likely key environmental and social issues associated with the construction and commissioning, operation and maintenance, and decommissioning phases of the Project
- Frame the scope for the baseline studies that support the ESIA
- Identify potential Project impacts that will be assessed further in the ESIA
- This ESIA Report has been prepared in accordance with internationally accepted standards.

1.2.1 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 stage of the OVOS has been submitted and has been approved. It is important to note that the OVOS for Samarkand (and Jizzakh) would not be possible without the completion of the translocation of tortoises. The Samarkand OVOS was returned and additional comments requested in relation to ecology. The OVOS was only approved after the process of translocation was completed and confirmed in writing by the regional ecology department in Samarkand.

1.3 Project Team

1.3.1 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 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.

1.3.2 ESIA Consultants

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

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.

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.

1.4 Report Structure

This Report comprises the following sections, as outlined in Table 1-3.

Table 1-3. 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 proposed site is in the Kattakurgan District, Samarkand region, in the Republic of Uzbekistan. The nearest communities are Bulakchi and Damkhodzha. The Project Site is approximately 20km from the city of Kattakurgan and approximately 50km from Samarkand. The site can be accessed via a road at the south end of the facility.

The Project Site area is approximately 426 ha.

The overhead transmission line route is 4.5km, connecting the Project to the existing national grid substation Ishtihan.

2.2 Land Ownership and Use

The land in the Project area is classified as rainfed agricultural land and consists of open areas with mild slopes. The Zeravshan river is located approximately 2km from the northern boundary of the proposed site. Most land around the project site is organised under Sub Lease Agreements used for private farms or under Dehkan modality. Dehkan farms are rural household producers operating on small household plots received on lifetime inheritable tenure rights. In Uzbekistan, “household plots” were reclassified as "dehkan farms" in 1998, when the Law of Dehkan Farms was passed[1]. Household plot is a legally defined farm type in all former socialist countries in CIS and CEE. This is a small plot of land (typically less than 0.5 ha) attached to a rural residence. The household plot is primarily cultivated for subsistence and its traditional purpose since the Soviet times has been to provide families with food.

Historically the Solar PV Site Area itself was sub-leased to five private leaseholders discussed in section 6.7.6.

The Project Site boundaries were optimised to use the available space excluding legally farmed land at the north end of the Project Site, the northern portions of the site with uneven topography and deep gullies, and the cemetery. The entire site was previously used for the cultivation of wheat but more recently the land was given over to a larger number of small farms. Past cultivation was evident across the entire site area.

AECOM understands that the cultivation of smaller parcels was not profitable, and the five historic leaseholders have subsequently had their leases revoked and the land acquired by the local authority for the Project. All the households who were subject to the land acquisition process continue to commercially farm the new provided land except for two historic leaseholders who have gained considerable debts accrued due to the land acquisition process and/or were allocated unsuitable land.

The route of the overhead transmission line passes through agricultural land before connecting to the substation at Ishtihan. Land required for connection to the substation is within the substation boundary.

A Land Acquisition Audit (LAA) and Livelihood Restoration Plan (LRP) have been undertaken in parallel with the ESIA for the five historic leaseholders that were previously farming on the site area prior to acquisition for the Project.

[1] Law on Dehkans, Head 1, article 1, 1998

Figure 2-1. View to the centre of the site

Figure 2-2. Zarafshan river to the north of the site

The overhead transmission line has been designed with the purpose of avoiding any populated areas or isolated structures. In some sections, however, the corridor will need to cross along extensive areas of cultivation, whist several poles will need to be pegged within the boundaries of dekhan farms.

2.3 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 2-3 shows the key principles and associated structures of a PV facility.

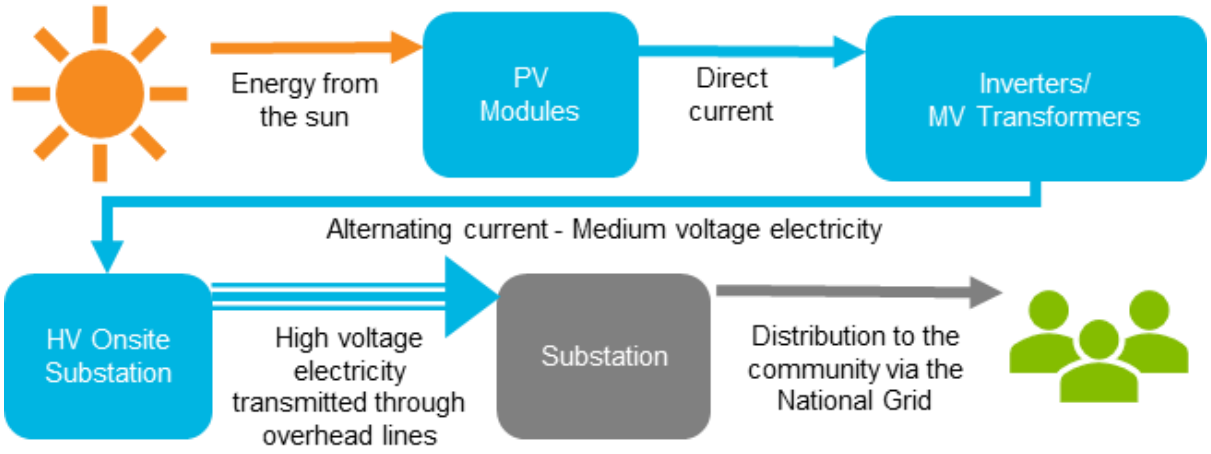

Figure 2-3. PV power plant overview

2.4 Project Design

2.4.1 Solar PV Site Layout

Gated access to the facility will be located at the south end 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 southwest 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 fence surrounding the PV plant is approximately 10km long. The total length of the proposed internal road network is approximately 28km.

The final layout and detailed design will be provided by the EPC contractor during the detailed design phase of the Project.

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.

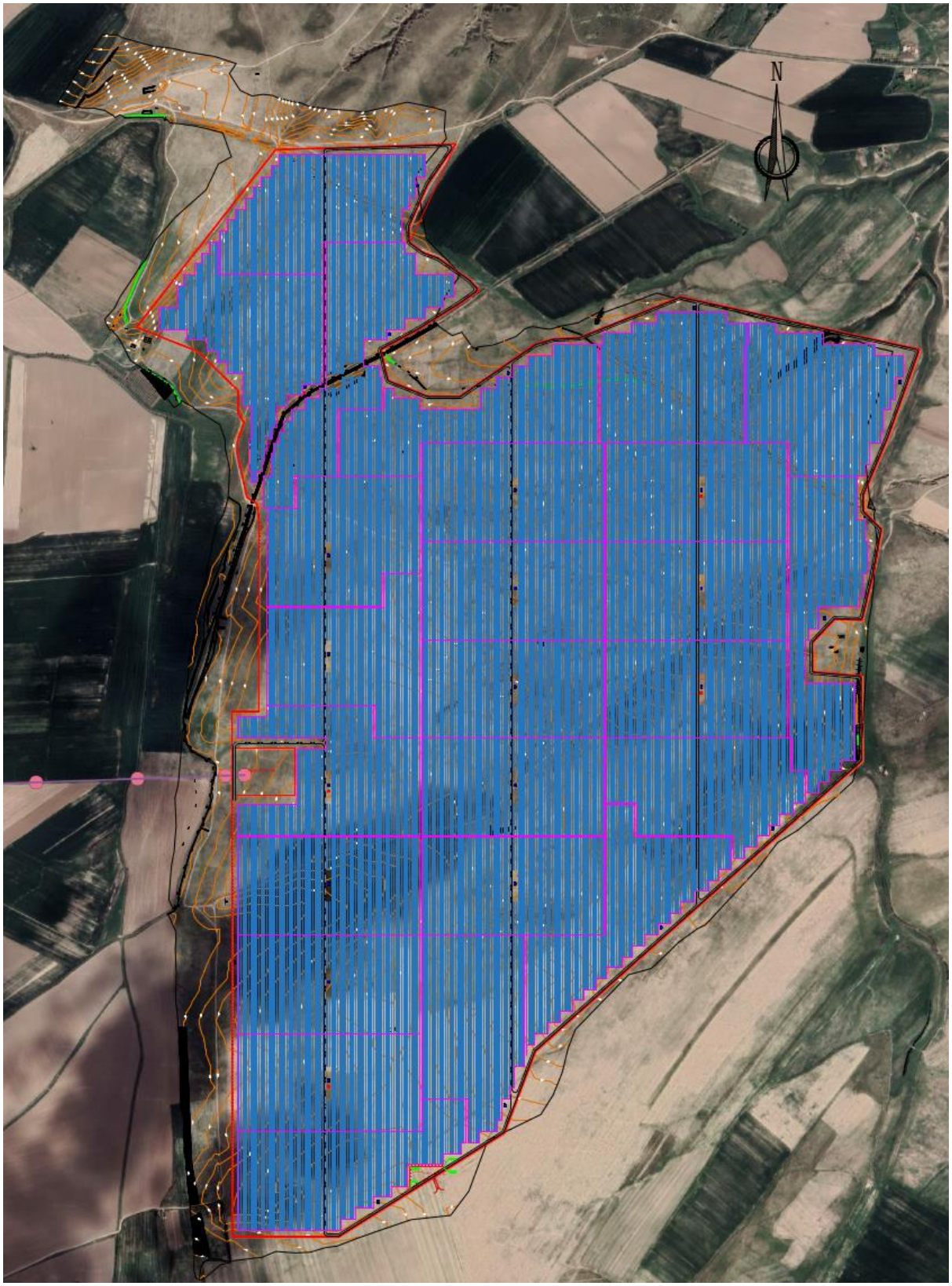

Figure 2-4. PV power plant layout

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

Table 2-1. Project components

Component	Value
Area of Project Site (Ha)	426
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 maximum
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 535
Number of Jobs during the Operational Phase	Up to 25
Installed Capacity (MWac)	220
Project Annual Electricity Generation (kWh)	594,209,000

Source: Masdar

2.4.2 Solar PV Modules

The current design envisages that the Project will comprise 449,064 modules. These are likely to 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 2-5. 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.

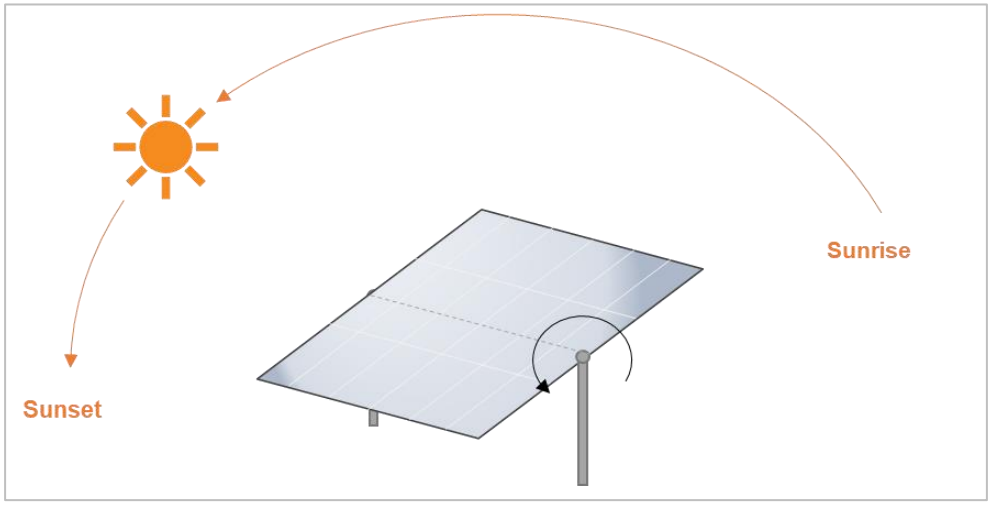

Figure 2-5. Schematic Diagram of Single-Axis Tracking System

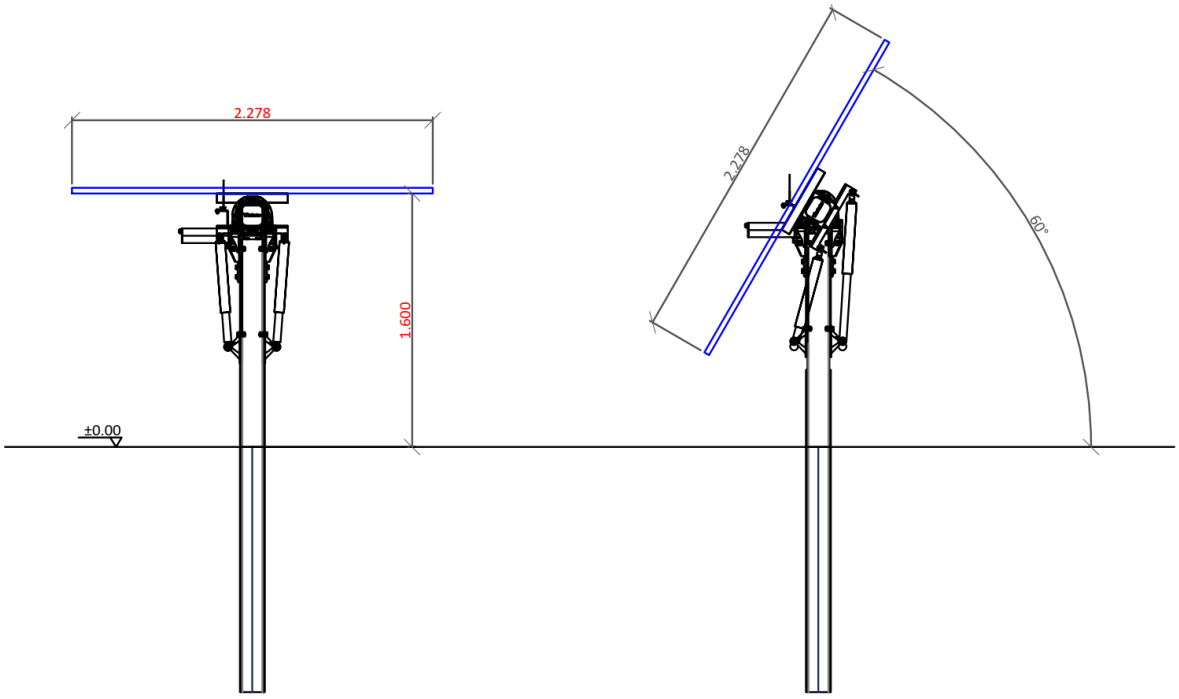

Figure 2-6. Tracker profile view

2.4.3 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 2-7. 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.

Based on the soil and surficial geological conditions of the site, driven steel piled foundations are deemed appropriate for the Project (TYPSA, 2020c). Driven steel piles are fast to install, cost effective, are suitable for a wide range of soil types and are not affected by ambient temperature fluctuations.

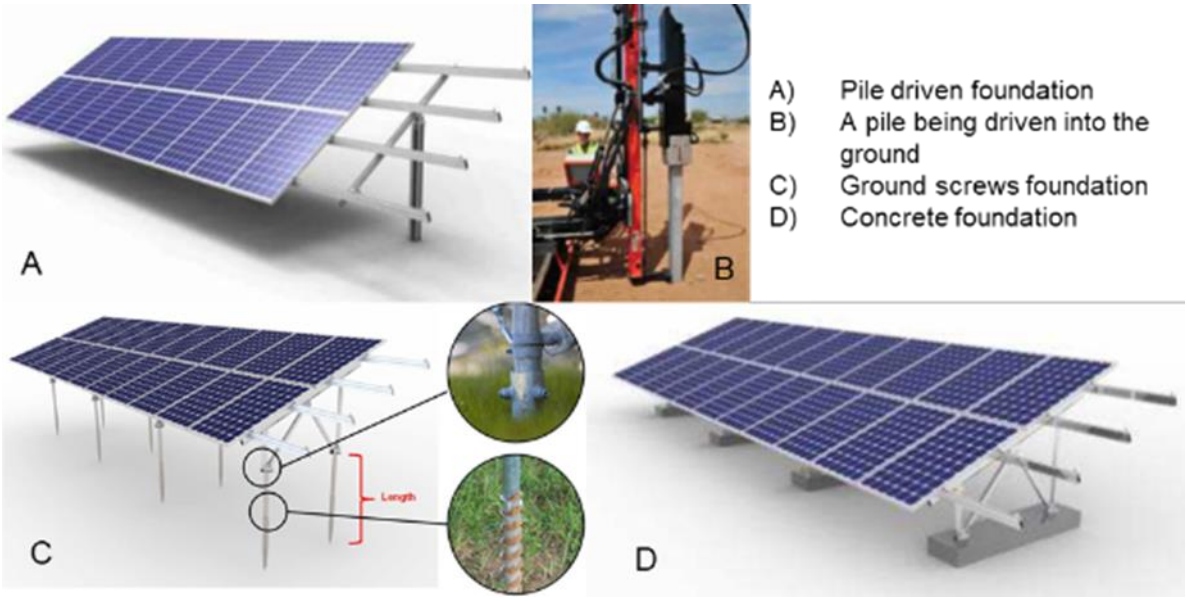

Figure 2-7. Foundation options

Source: ILF Consulting Engineers, 2019

Figure 2-8. Example of fixed tilt solar panels on H-style steel piles

Source: TYPSA, 2020a

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

2.4.4 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 generally quieter than central inverters. The Project will likely use string inverters, such as Sungrow String inverter SG250HX-IN-20. It is estimated that approximately 1,000 string inverters will be required for the Project but this will be confirmed by the EPC contractor following final project design.

Figure 2-9. Central inverter (left) and string inverter (right)

Source: SMA Solar Technology AG; Sungrow, 2019

2.4.5 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.

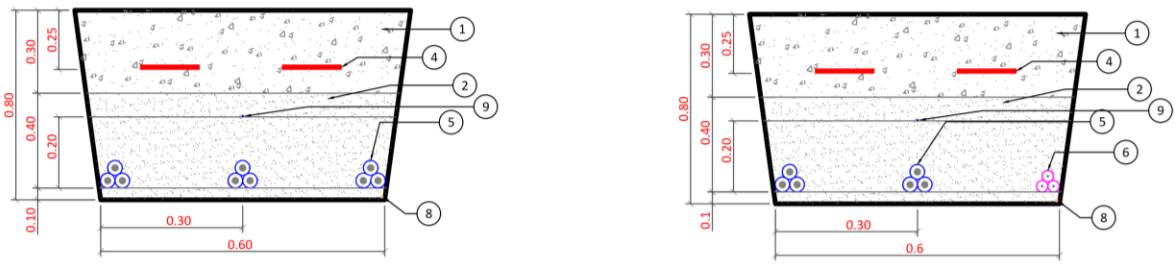

Figure 2-10. Cable trenches

2.4.6 On-site Substation

The on-site substation will transform the generation voltage level (35 kV) to the utility voltage (220 kV) through two 90/125 MVA power transformers and the associated electrical devices. The substation will be air insulated, due to the normal climatic conditions and ambient pollution levels, with electrical devices mounted over metallic supports and interconnected with aluminium conductors.

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

- MV switchgears
- Protection and control panels and HMI
- AC/DC auxiliary power supply panels
- DC battery banks (in a separate room) and chargers
- 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.
- 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.

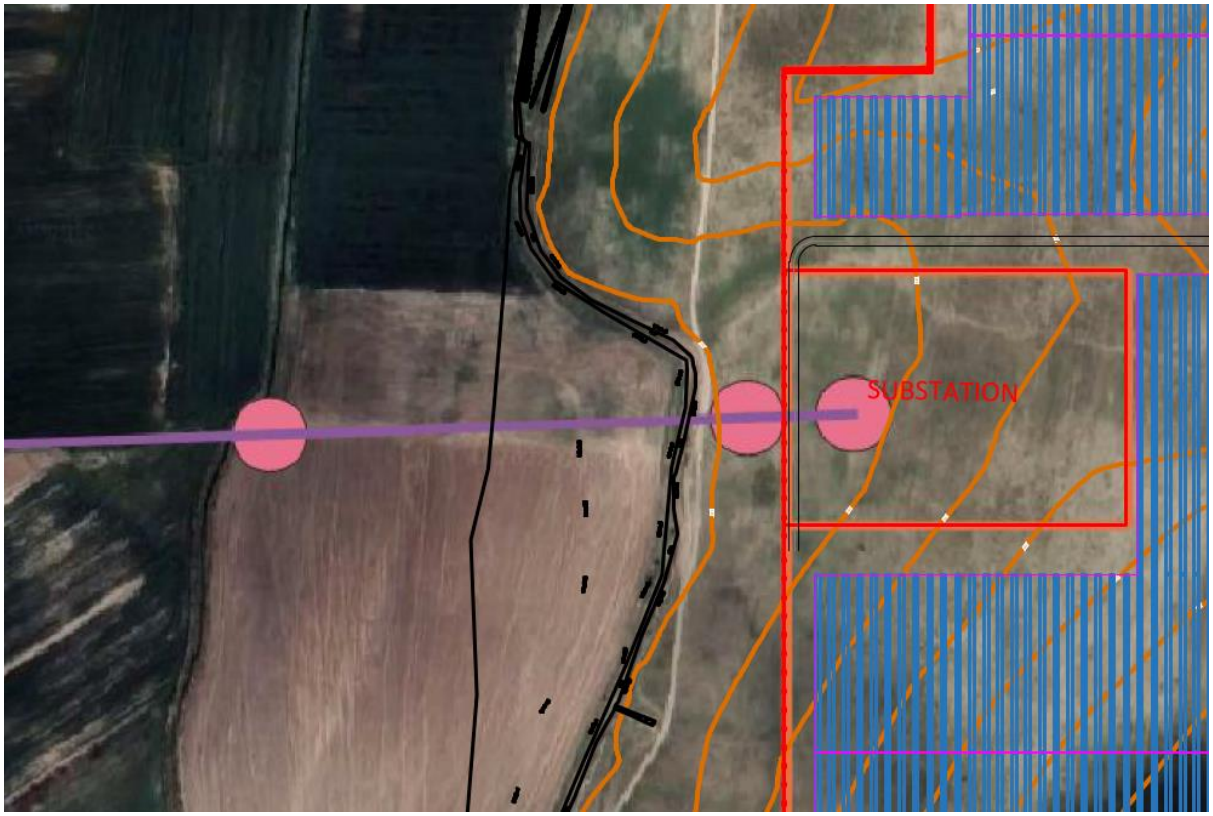

Figure 2-11. Location of on-site substation

2.4.7 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.

2.4.8 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.

2.4.9 Interconnection Line

Samarkand solar PV plant is designed for a total 220 MWac installed power capacity. Evacuation of the energy produced shall be made to the existing Ishithan substation located 4.5km from the Project generation 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 4.5 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 (OHL) shall be installed over 22 lattice type steel towers, double circuit, one cable per phase, and with two optical ground wires (OPGW) as ground wire and for telecommunications.

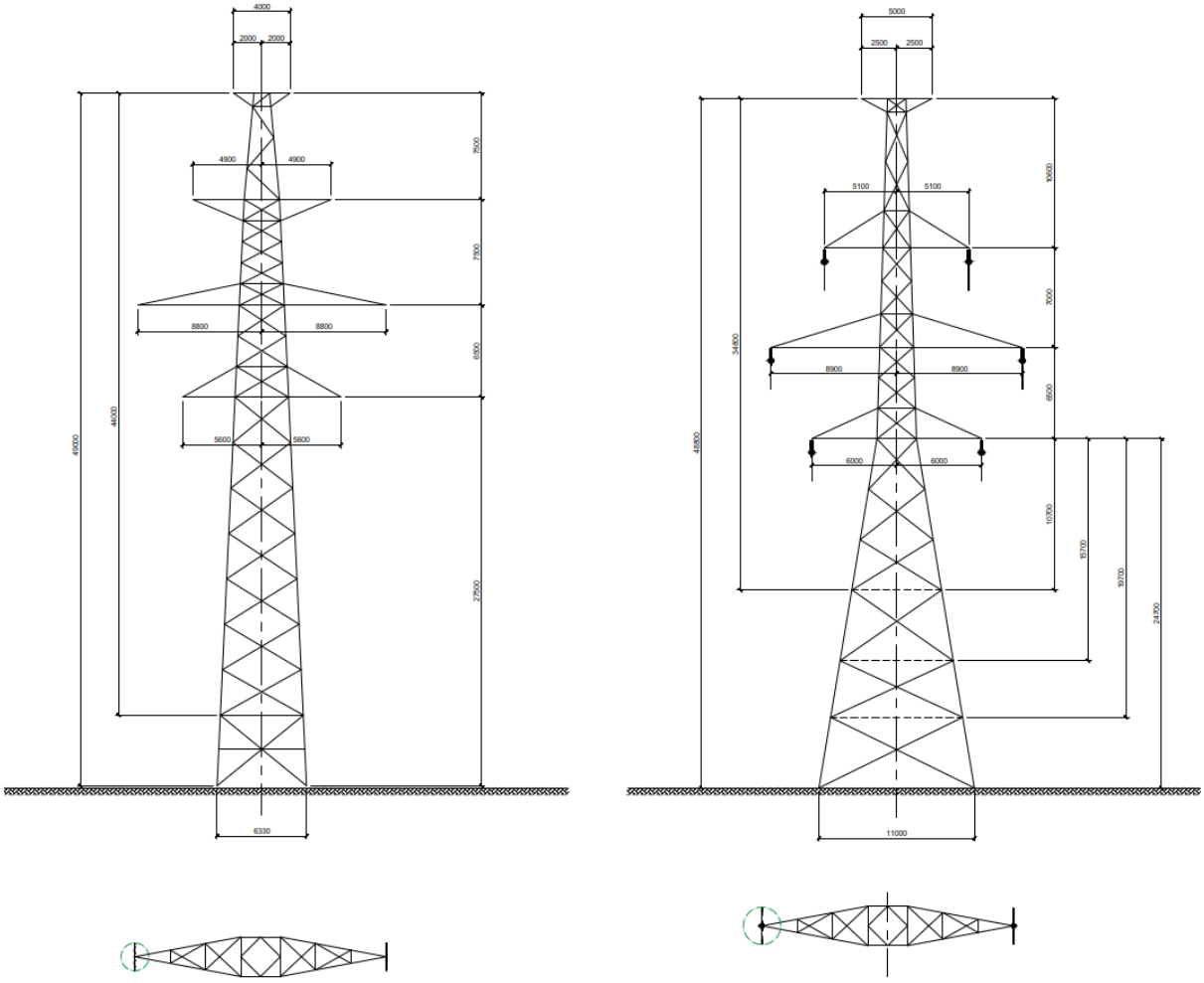

Figure 2-12. Steel lattice towers for the overhead line

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.
- Locate the transmission line to avoid passing through settlements and populated areas.
- Minimize the need to build new access roads and 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.

Bird flight diverters (Firefly brand) will be installed on both earthing cables, on the full length of the high voltage line. The distance between elements will be 10 m.

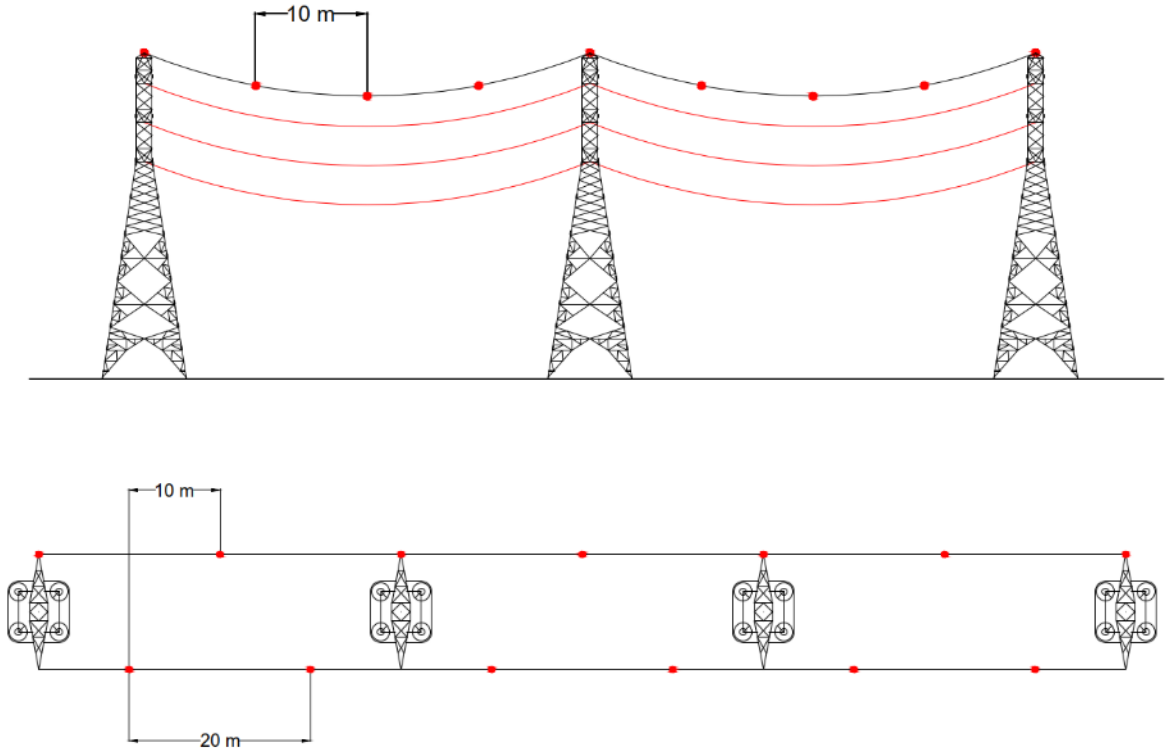

Figure 2-13. Location of the bird protection devices on the overhead lines

Source: TYPSA, 2020b

2.4.10Office Building

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

2.4.11Fencing 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 2-10.

Figure 2-14. Typical Fence and CCTV System at a UK PV Facility

Source: AECOM, 2019

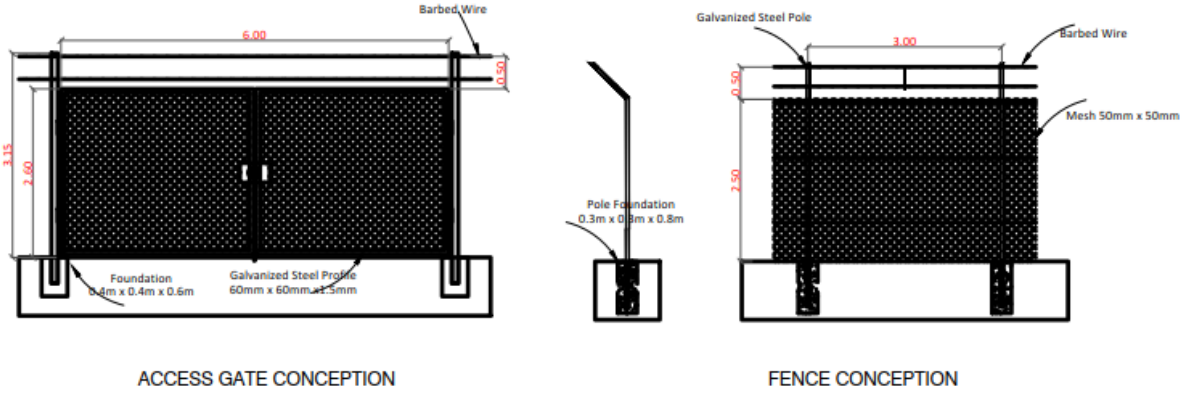

Figure 2-15. Fence and Access Gate

2.5 Construction

2.5.1 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.

2.5.2 Construction Activities

It is assumed that construction will be carried out by an EPC (Engineering, Procurement and Construction) contractor and that the main site preparation and construction activities will be the following (but not limited to):

- Site Preparation and PV Power Plant Installation:
- Required road upgrades and widening of turning radii, where needed.
- Import of components to Site
- Construction of temporary construction camp, construction lay-down area and other infrastructure.

- Site preparation: removal of vegetation and any remaining structures followed by grading of the solar PV and sub-station area and fencing of construction area for community safety.
- Construction of the internal road network.
- Construction of foundations, mounting structures, assembly, and erection of structures to support PV panels.
- Construction of substation and electrical control room, site offices, storage, and services.
- Installation of solar panels
- Construction of array enclosures and power block foundations and housing, and
- Installation of cables.
- Erection of permanent facility fencing.
- Construction of transmission line and interconnection works at the existing Ishithan substation located at about 4.5km from the Project site.
- 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.

2.5.2.1 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. Viable alternative access routes shall be considered during detailed design with the view to select the route that reduces the potential impacts to as low as reasonably practicable. Impacts associated with the access road (including but not limited to traffic safety, land ownership, noise, dust emissions) shall be assessed and mitigated before construction commences. Strict speed limit to be applied (10kmph) in locations where it is necessary to reduce noise impacts and safety risks. It is not expected that any further land take is required but if any displacement related impacts occur as a result of the access road, the Livelihood Restoration Plan shall be updated.

2.5.2.2 Stores and Power Control Centre, and Storage Facilities

The power control centre and storage facilities will be constructed on site where all equipment will be stored. This will help to limit the potential ecological impacts associated with this phase of the project to within one designated area.

No permanent fuel storage at site is anticipated. For vehicle refuelling, a petrol station has been identified within 5 km from the site and will be used. For heavy equipment, a fuel truck will be used as required and will be during a pre-specified refuelling time, most likely on a weekly basis.

No concrete batching plant is currently proposed. Ready Mix concrete will be used from a supplier based local to Kattakurgan.

2.5.2.3 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 Kattakurgan 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 2-16. 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 2-2. Earthworks

Parameter	Area
Length of fence (m)	11,000
Area of internal roads (m2)	90,000
Area of external access road (m2)	2,500
Area of substation (m2)	24,388
Area of inverter bases and any other infrastructure or hardstandings (m^2)	566
Area of laydown area (m^2)	18,000
Area shaded by PV panel (m^2)	1,160,045
Area of land left free of panels (m^2)	3,099,955
Land Boundary Area (m2)	4,260,000

Source: Masdar

Based on the initial site design as set out in the table above, a total of 14.6 ha land would be cleared or just over 3% of the overall site area.

2.5.2.4 Workforce

Masdar estimate that the workforce during the peak construction period is 535 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. This will be confirmed by the EPC contractor.

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.

2.5.2.5 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.

2.5.2.6 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)).

2.5.2.7 Emergency and Safety Support Systems

Management of the Solar Park will ensure periodic monitoring and upgrading of the safety support systems. These include; the firefighting equipment and well-marked emergency exit routes and assembling points, the necessary signage posts erected in all areas susceptible to dangers, general information and prohibitions. Portable fire extinguishers consisting of dry chemical carbon dioxide and foam type are to be provided at strategic locations in the plant. Adequate numbers of sand buckets are to be provided at various locations and there will also be a water hydrant system at the site.

First Aid units fully equipped with the necessary materials shall be provided and proper protection gear shall be availed to employees and visitors at the plant. All the above will be supported with comprehensive continuous employee training and awareness on environmental, health and safety matters. An emergency action plan that includes the procedures for handling leaks and spillage will be developed.

A written health and safety plan will be developed by the EPC Contractor for the facility prior to construction using established safety procedures for power generation plants as guideline. This will be available in both Chinese and Russian/Uzbek. Employees will be intimately involved with the development of the process hazard analysis and on the development of other elements of process safety management required. Access to this data and all other pertinent information will be made readily available to all employees and onsite contractors.

Clear written operating procedures for safely conducting activities within the plant will be developed. This includes steps for each operating phase, operating limits, safety and health considerations and safety systems and their functions. This document will be readily accessible to employees who work on or maintain a covered process and will be reviewed as often as necessary to assure they reflect current operating practice. Safe work practice will be implemented and will provide for special circumstances such as lockout/tag out and confined space entry and training limits.

2.5.2.8 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 preparation, etc

The amount of water required during construction is estimated at up to 100,000 m^3. The source of water is currently subject to consultation between the EPC Contractor/ Masdar and the Water Authority. It is assumed that water would be delivered by tanker but this will be confirmed by the EPC contractor. In addition, a further 13,133 m^3 of water is required for the workforce. All drinking water would be bottled water.

The Project site would be connected to the national grid to provide electricity for construction through a contract with the distribution company.

2.5.2.9 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 2-1.

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 2-3. Estimated Construction Traffic

Vehicle Type	Activity	Total Vehicle Movements
HGV	Delivery of materials, plant, containers, concrete, aggregate material and welfare facilities	13,266
LGV (people carrier up to 6 people)	Transportation for construction workers to site.	3,080

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.

2.5.2.10 Waste Management

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. No recycling facilities have been identified however waste will continue to be segregated for recycling should the EPC Contractor identify suitable sites in future.

The Project will not construct or operate its own wastewater treatment, landfill, or recycling facilities. The volumes per day of domestic and sewage waste expected to be generated has yet to be confirmed by the EPC Contractor. Nevertheless, wastewater and sewage would be stored in a central tank on site. Tankers would be deployed to remove 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 2-4. These volumes will be confirmed by the EPC contractor.

Table 2-4. 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	HOLD
Concrete	4 m^3
Asphalt paving	2 m^3
Scrap steel	10 t
Glass	HOLD

Plastics	10 m^3
Packaging materials	20 m^3
Wood	10 m^3

2.5.2.11 Infrastructure Requirements during Construction of Power Plant

The construction of the Solar Park will require a number of temporary infrastructure and services will be required:

- Construction compound that will include offices, parking, as well as equipment and material storage,
- Purpose-built storage for hazardous materials.
- Purpose-built facilities for the segregation and temporary storage of wastes.
- Effluent and storm-water drainage.
- Sanitation and sewerage disposal.
- Water supply system including reservoir and a 1,050 m pipe connecting to a public water pipeline. This system will be used during construction and remain in place during operation.
- On-site electricity supply (by means of diesel generator).
- Road access.
- Medical facilities on-site.

2.5.3 Operation

Masdar will be responsible for the design, build, finance, operation, maintenance, and transfer (DBFOMT) of a solar PV power plant of 220 MWac in the Kattakurgan District, Samarkand Region of Uzbekistan. 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.

2.5.3.1 Routine Maintenance Activities

Operation and maintenance of the facility will include:

- Periodic cleaning of PV modules depending on soiling and sand/silt accumulation
- Replacement of faulty PV modules
- Preventative maintenance and repair of inverters, mounting structures, surge arresters, cables and PV junction boxes, and meteorological station
- Maintenance of site security, fencing and gates
- Cleaning of ditches and drainage culverts
- Delivery of water and emptying the septic tank
- General upkeep of the territory within the Solar PV Site

2.5.3.2 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.

2.5.3.3 Water Requirements

Cleaning strategy will be dry cleaning and defined in the operations and maintenance contract. It is proposed that water would be tankered to site but this will be confirmed by the EPC Contractor.

Bottled drinking water would be provided to the workforce during operation.

2.5.3.4 Waste Management

Solar PV electricity generation does produce 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 landfills and recycling facilities.

Estimated waste arisings for the operational phase are summarised in Table 2-3.

Table 2-5. 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.

2.5.4 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.

2.6 Alternatives

2.6.1 No Project Alterative

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.

2.6.2 Site Selection

The Government of the Republic of Uzbekistan identified several potential sites for the utility scale solar PV facilities throughout the country, including Jizzakh region. Following site screening visits by the engineering company TYPSA and decisions by the Government of the Republic of Uzbekistan, the Solar PV Site subject to this report was carried forward and selected for further studies. Neither AECOM nor Masdar were able to obtain the site selection study that was carried out as part of IFC's Scaling Solar programme.

The 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.

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

Furthermore, 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.

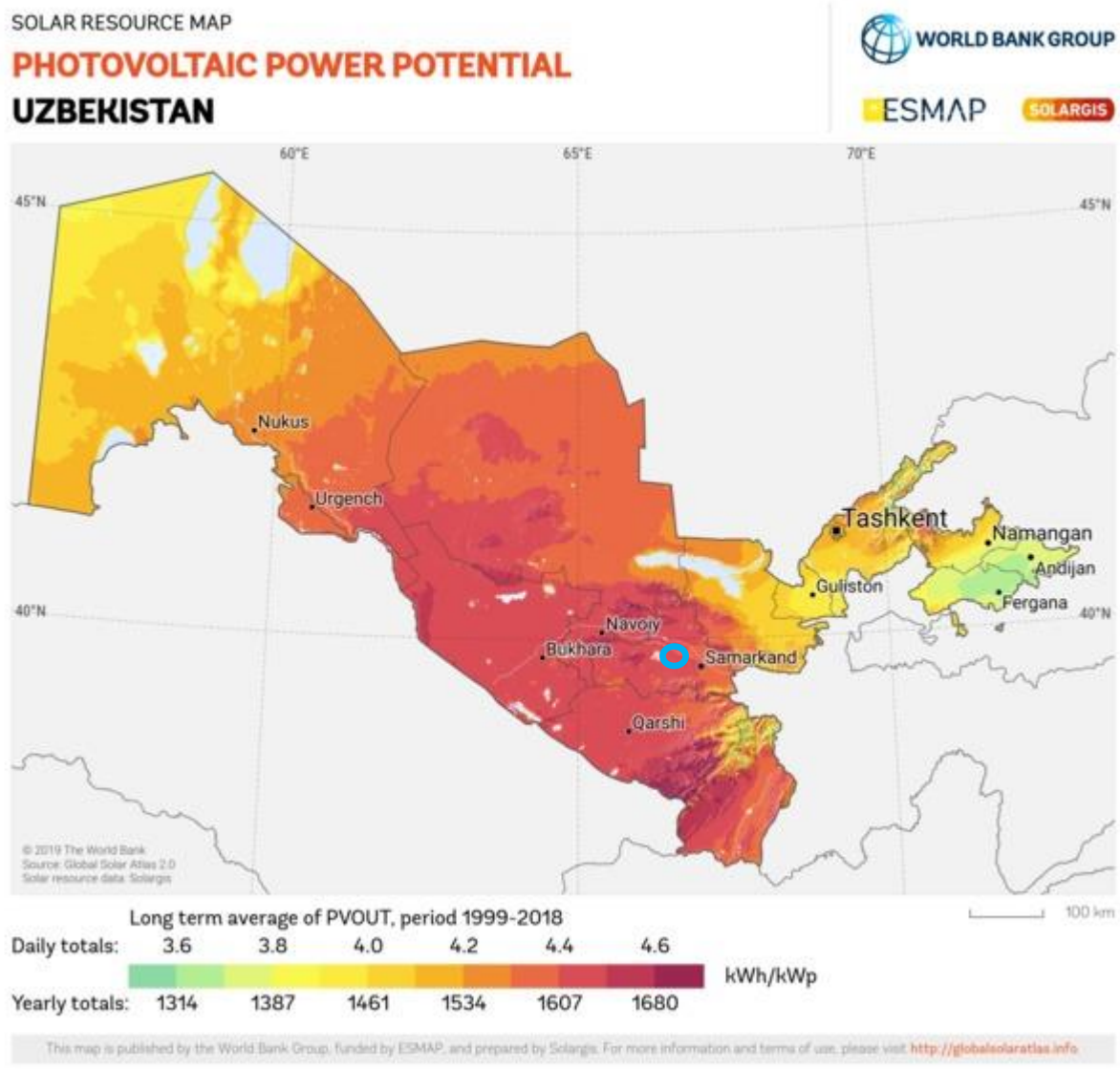

Figure 2-17. Solar resource map (site shown in blue)

Table 2-6. Summary of site selection criteria

Criteria	Overview	Likelihood of significant impact[2]
Solar resource	As can be seen on Figure 17 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	The Kattakurgan Water Reservoir is an Important Bird Area (IBA situated in a natural depression approximately 15km to the south-west of the Project site at its closest point; it is a non-protected area. Consultation with Birdlife International and ornithological experts (IBA Programme since 2008) was undertaken and reported in TYPSA/IFC (2020); this highlighted that none of the species for which the IBA site was designated use the Project site, with the exception of the potential for Asian houbara bustard. The project site does not appear to mirror any of the qualifying features of those areas and as a result the project would not expect to impact on those sites.	Project is not expected to impact on designated sites.

[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.

Residential properties	There was one potential property identified on or close to the site but AECOM understand that this is no longer being used. As a result, no physical resettlement would be required. 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 tracks are still being finalised and a preferred route will be identified that minimises the impact on the surrounding residential properties.	Access route will 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 centre of Kattakurgan. 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 and would make the project unviable from a legal and permitting perspective. 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 relatively short ~4.5km connection is deemed to be positive 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 avoiding the nearby village. Any alternative overhead route would increase the length of the transmission line and increase the potential collision risk of CH qualifying species.	Most direct grid connection route has been chosen. Land use impacts would be minimised.

	In accordance with EBRD PR 6, Para 13. it is not considered that there are any technically or 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 full site has been used for winter wheat. 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 northwest of the site. The installation of towers would require a significantly lower amount of land take	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 majority of recent cultivation was winter wheat. The quality of the land is poor which was the main reason why cultivation was discontinued. Five parcels of land had been cultivated within the site however all had vacated the site by the time of AECOM's site visit. The house observed from aerial maps was confirmed to be partially demolished and uninhabited. Affected people adjacent to the project site is restricted to those using the land for grazing. The land surrounding the project is intensively farmed and land use is considered typical for the region. It is clear that there is a lot of higher value agricultural lands being actively farmed which the project has avoided. 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 majority of recent cultivation was winter wheat. The quality of the land is poor which was the main reason why cultivation was discontinued. The land was cultivated as a single block. 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 to the better grazing areas to the east. The land to the west and south of the project is intensively farmed and land use is considered typical for the region. It is clear that there is a lot of higher value agricultural lands being actively farmed which the project has avoided. 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 the LRP. An estimate of 2,750m2 of land take would be required for the 22 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 270,000m^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	Confirmed that project land is not productive and alternative land is available for grazing. OHTL route minimises impacts on farmland.

	changed without renegotiating a new contract with GoU and the off-taker. Again, this would require significant time extensions which would not be able to be accommodated within the project construction schedule	
Biodiversity	Great bustard is a native non-breeding (winter visitor) to the Jizzakh and Samarkand region of Uzbekistan. In total an overwintering population of 924 Great Bustard were recorded in 2020./21 and this represents 61.6 to 92.4% of the Central Asian population. Great bustard is identified as a CH qualifying species and, as such, net gains would need to be met. The solar PV site and OHTL route are not considered to be suitable for this species as a staging or wintering habitat and it is therefore considered that the Project AoI is unlikely to be of significant importance for wintering Great Bustards within Uzbekistan. It is considered that the solar PV site does not provide suitable habitat and that other more suitable habitats are available and utilised by great bustard. Therefore, the solar PV site is not assessed to impact this species. However, the OHTL would increase the collision risk for this species as they travel between overwintering areas and would be mitigated on the OHTL to some extent by Firefly brand bird flight diverters. It is recognised that diverters may have limited success in reducing bustard collisions therefore offsets will be provided to further mitigate potential impact on great bustard and demonstrate a net gain. The OHTL travels away from the EAAA for the species and represents the most direct feasible route. As noted above, any alternative OHTL route would increase the length of the transmission line and increase the potential collision risk of CH qualifying species. Therefore, from a biodiversity perspective, having the shortest viable length of OHTL would be the preferred option to minimise collision risk. In accordance with ADB SR1 and EBRD PR 6, Para 16, the project's mitigation strategy will be described in a Biodiversity Action Plan...	No great bustards were recorded on site and it is considered that there is a low likelihood that the OHTL would cause significant impacts on this population, as the OHTL is outside the habitat directly used by bustards. Specific measures will be put in place to reduce potential collision impacts for Great Bustards, and to compensate for any that might occur, including offsets.

2.6.3 Transmission Route Selection

The land between the PV site and the substation is almost entirely actively farmed land with a small settlement to the southwest. No sensitive areas were identified during site surveys therefore a route was chosen to follow field boundaries where possible and to avoid crossing through the settlement. The route chosen represents to shortest viable route, minimising cost as well as the impacts of farming and livelihoods.

There are not assessed to be any options that would offer a better alternative in terms of environmental and social impacts therefore route was further optimised based on the following:

- The route has been altered in order to avoid the water channel
- The route was modified in order to cross the existing OHTL at approximately 90 degrees . This is a technical requirement as per local standards/norms.

The following figure was provided by Masdar showing the route optimisation as agreed with the Regional Government of Samarkand region. Note the green line shows the water channel (irrigation canal), blue line is the optimised OHTL and the red line shows the original OHTL route.

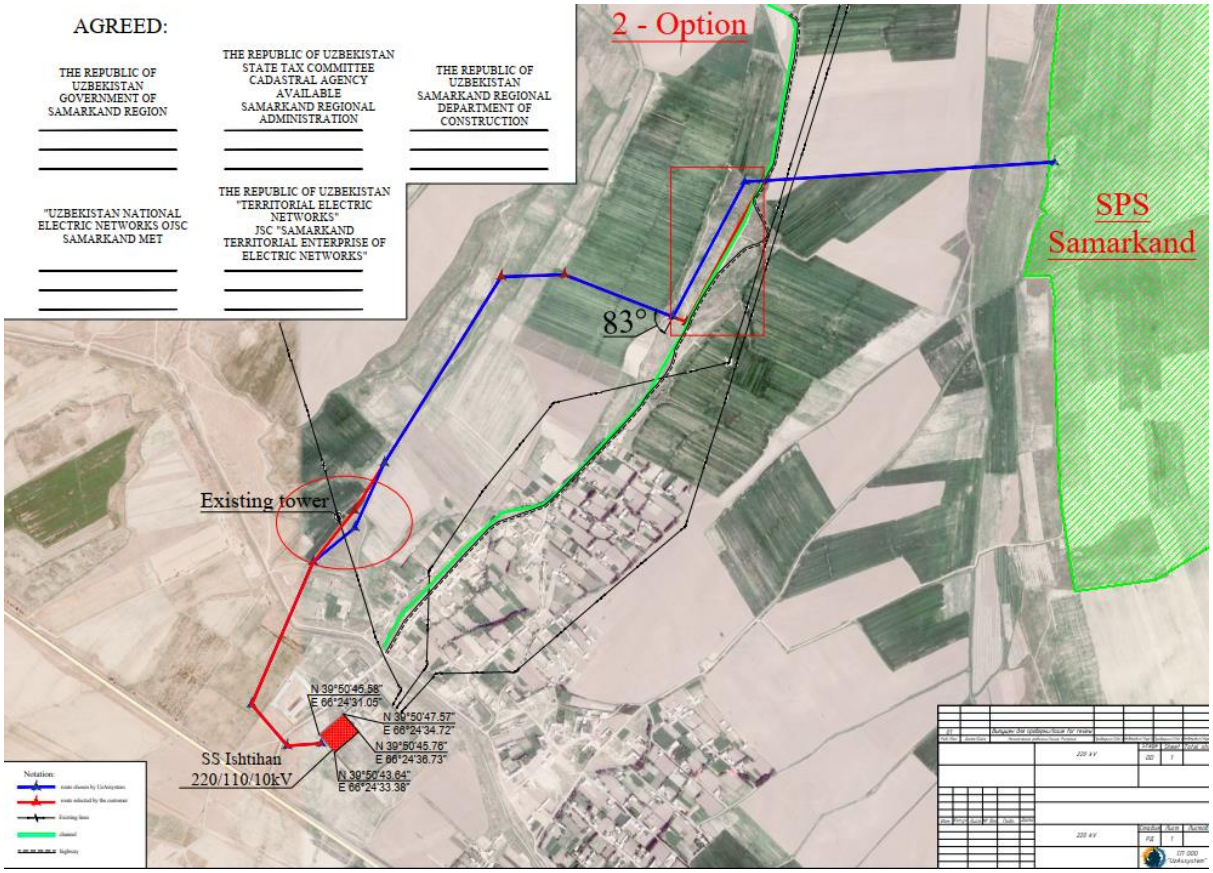

Figure 2-18. OHTL options

2.6.4 Access Route Selection

Access route selection is still being undertaken for the project. Options are screened on an initial 200m buffer to minimise noise and community health and safety impacts. Where no suitable options exist, AECOM and Masdar will identify those with least impacts that are still technically viable.

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% 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% of the total volume of electricity generation
- Increase of the energy efficiency of industrial enterprises by at least 20%
- Development of electrical vehicles
- Introduction of drip irrigation technology into an area up to 1 million hectares and increasing the crops yield cultivated on them by 20–40%
- Achieving a neutral balance in the degradation of land
- Increasing the average productivity of the production of the main types of agricultural food products by 20–25%
- 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 environmental and social 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

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

of administration (khokims). Regional and local government 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 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 Environment 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 consist of taxes, 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 Environment 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. 13.12.2002г. (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 Environment 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 environment 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 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:

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

- 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 Land Ownership

Management of land is governed by the rules stated within the Presidential Decree of June 8, 2021 No. UP-6243 “On measures for ensuring equality and transparency in land relations, reliable protection of land rights and their transformation into market asset”. According to the Decree, land is allocated on the basis of the right of permanent use to State bodies, institutions, enterprises and citizens' self-governing bodies. Key provisions of the Decree are as follows:

- In implementing public-private partnership projects, land is allocated to the relevant public body, which in turn provides a private partner with a lease for the duration of the agreement.
- Agricultural land is allocated only on the lease basis following online auction.
- Non-agricultural land can be allocated on the basis of ownership and leases following an online auction.
- Local authorities are prohibited from directly allocating land plots.
- Cabinet of Ministers can directly lease land plots to agricultural clusters and to large investment projects.

3.3.5 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).

3.3.5.1 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 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 3-1.

Table 3-1. 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 High 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

[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
[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

	and participate in the historical and cultural examination of archaeological heritage sites.
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.
Presidential Decree No. PF-5953 "On Measures to Strengthen the Protection of Tangible Cultural Heritage Sites and Areas Included in the UNESCO World Heritage List" (3 March 2021)[11]	Sets out administrative and organisational measures for defining, monitoring and protecting World Heritage Sites. Indicates ongoing programmes to maintain, protect, preserve, research, popularise and use the objects of tangible cultural heritage. Notes the revision of the national list of real estate objects of tangible cultural heritage and ongoing tangible and intangible heritage inventory programmes.

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 High 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[12] 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

[11] Presidential Decree No. PF-5953 of 3 March 2021 "On Measures to Strengthen the Protection of Tangible Cultural Heritage Sites and Areas Included in the UNESCO World Heritage List. Available at: https://lex.uz/docs/-5320217

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

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, 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. Changes are further detailed in Presidential Decree No. PF-5953 "On Measures to Strengthen the Protection of Tangible Cultural Heritage Sites and Areas Included in the UNESCO World Heritage List" (3 March 2021).

The national list of objects of real property of a material cultural heritage is contained in Appendix 1 to the Cabinet of Ministers Resolution No. 846 "About approval of the National list of objects of real property of a material cultural heritage" (October 4, 2019)[13]. [https://lex.uz/docs/-4543266] Updates are set out in the Appendix 15 to Presidential Decree No. PF-5953, Amendments and additions to some decisions of the Government of the Republic of Uzbekistan[14].

3.3.5.2 Uzbek International Agreements and Conventions

Environmental and social conventions and agreements of relevance to archaeology and cultural heritage are outlined in Table 3-2.

Table 3-2. 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[15]	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[16]	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[17]	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[18]	Recognises the rights of states to protect and promote the diversity of cultural expressions, encompassing cultural and natural heritage, movable	15 November 2019 (ratification)

[13] Cabinet of Ministers Resolution No. 846 "About approval of the National list of objects of real property of a material cultural heritage" (October 4, 2019). Available at: https://lex.uz/docs/-4543266
[14] Presidential Decree No. PF-5953 of 3 March 2021 "On Measures to Strengthen the Protection of Tangible Cultural Heritage Sites and Areas Included in the UNESCO World Heritage List." Appendix 15, Amendments and additions to some decisions of the Government of the Republic of Uzbekistan. Available at: https://lex.uz/docs/-5320217
[15] 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/
[16] 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/
[17] 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
[18] 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

cultural property, intangible cultural heritage and contemporary creativity.

3.4 International Agreements

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

Table 3-3 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 3-3. International Environmental and Social Conventions Ratified by Uzbekistan

Name of Convention	Date of Ratification
C029 - Forced Labour Convention, 1930 (No. 29)	13 Jul 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 Jul 1992
C100 - Equal Remuneration Convention, 1951 (No. 100)	13 Jul 1992
C105 - Abolition of Forced Labour Convention, 1957 (No. 105)	15 Dec 1997
C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	13 Jul 1992
C138 - Minimum Age Convention, 1973 (No. 138)	6 Mar 2009
C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)	13 Jul 1992
C122 - Employment Policy Convention, 1964 (No. 122)	13 Jul 1992
C187 - Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187)	14 Sep 2021
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (IEA ID# 2793)	8 Feb 2002
Convention for The Protection of The World Cultural and Natural Heritage (IEA ID# 2812)	13 Jan 1993
Convention on International Trade in Endangered Species of Wild Fauna and Flora (IEA ID# 2814)	8 Oct 1997
Convention on The Conservation of Migratory Species of Wild Animals (IEA ID# 2896)	1 Sep 1998
Convention for The Protection of The Ozone Layer (IEA ID# 2982)	16 Aug 1993
Montreal Protocol on Substances That Deplete the Ozone Layer (IEA ID# 3021)	18 Aug 1993
Convention on The Control of Transboundary Movements of Hazardous Wastes and Their Disposal (IEA ID# 3042)	7 May 1996
Agreement on cooperation in the field of ecology and environmental protection (IEA ID# 2489)	8 Feb 1992
Agreement on Cooperation in The Field of Joint Water Resources Management and Conservation of Interstate Sources (IEA ID# 3113)	18 Feb 1992
Convention on The Protection and Use of Transboundary Watercourses and International Lakes (IEA ID# 3116)	3 Dec 2007
United Nations Framework Convention on Climate Change (IEA ID# 3126)	21 Mar 1994

United Nations Convention on the Rights of Persons with Disabilities (CRPD)	28 Jun 2021
Convention on Biological Diversity (IEA ID# 3128)	17 Oct 1995
Statute of the Interstate Commission for Water Coordination of Central Asia (IEA ID# 4765)	5 Dec 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 Mar 1993
Convention to Combat Desertification in Those Countries Experiencing Serious Drought And/or Desertification, Particularly in Africa (IEA ID# 3188)	26 Dec 1996
Agreement on The Conservation of African-Eurasian Migratory Water birds (IEA ID# 3216)	1 Apr 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)	5 Apr 1996
Agreement on The Use of Water and Energy Resources of The Syr Darya Basin (IEA ID# 3279)	7 May 1999
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (IEA ID# 2793)	8 Feb 2002
Convention for The Protection of The World Cultural and Natural Heritage (IEA ID# 2812)	13 Jan 1993
Convention on International Trade in Endangered Species of Wild Fauna and Flora (IEA ID# 2814)	8 Oct 1997
Convention on The Conservation of Migratory Species of Wild Animals (IEA ID# 2896)	1 Sep 1998
Convention for The Protection of The Ozone Layer (IEA ID# 2982)	16 Aug 1993
Montreal Protocol on Substances that Deplete the Ozone Layer (IEA ID# 3021)	18 Aug 1993
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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:

- The Equator Principles (Equator Principles Association, 2020)
- IFC Performance Standards (IFC, 2012)
- IFC Environmental, Health and 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, 2007)
- IFC EHS Guidelines for Electric Power Transmission and Distribution (IFC, 2007)
- 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.

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 (EPs) is a risk management framework used by financial institutions to assess and manage environmental and social risk in projects aiming to support responsible risk decision-making. The EPs 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 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. Environmental and Social Assessment Methodology

The objectives of an ESIA are to identify the potential project impacts, assess their significance and develop mitigation measures to avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment. 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 chapters of this ESIA 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.

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.

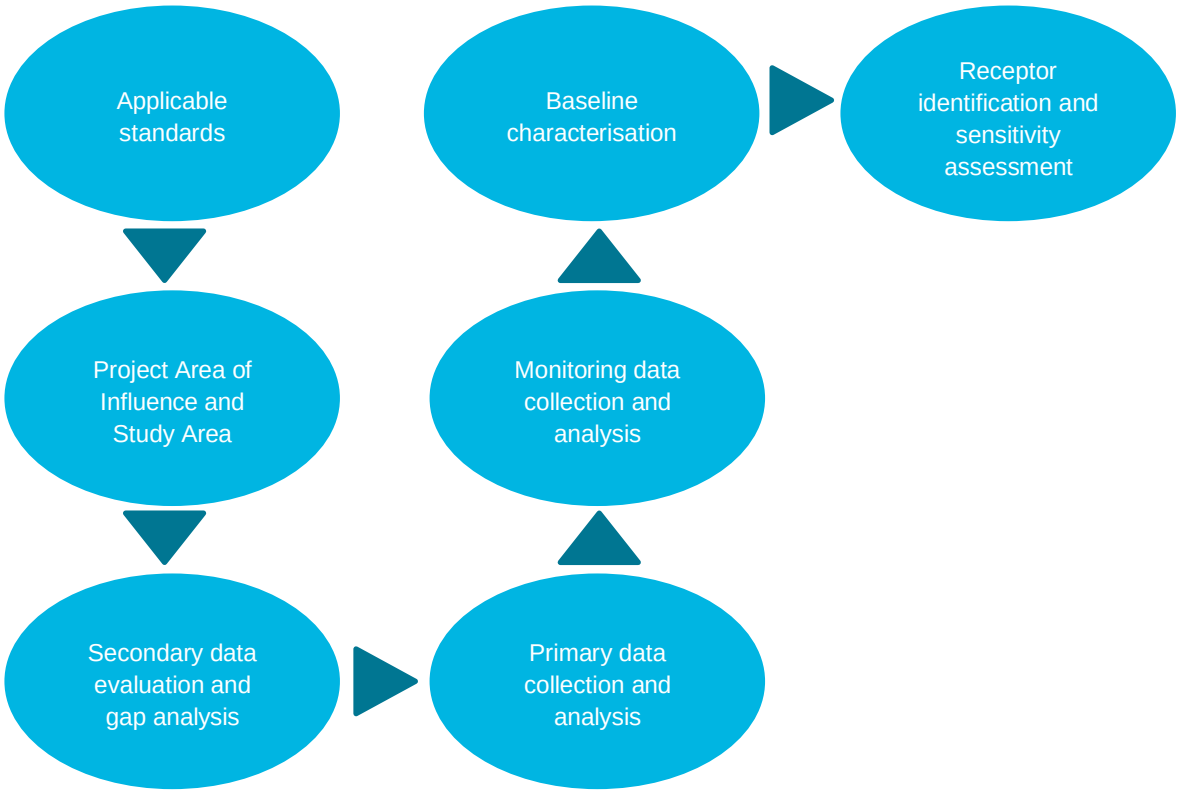

Figure 4-1. Approach to Baseline Characterisation

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'[19] 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.
- 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.

The AOI will be used to identify survey areas, stakeholders and project affected peoples (PAPs) who were targeted as part of the ESIA process. The AOI was then 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 has 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

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

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 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 4-1 and Table 4-2 below. However, it should be borne in mind that the criteria depend on the specific environmental aspect being considered.

Table 4-1. 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 4-2. 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.

Table 4-3. 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 November 2021 and with the individual Makhallas during the same visit. The area of search was at the district level (Kattakurgan) 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 is one development of a similar scale – the Kattakurgan cement plant.

The Khokimyiat confirmed a 2.4Mt/yr cement plant in the Kattakurgan district of Samarkand. The project has an investment of US$420m, according to the Uzbekistan National News Agency. The first stage of construction created a 1.2Mt/yr plant in 2020. The plant is now expanding its production capacity with a planned completion date of 2023. A further 100 construction jobs are expected to be created. Given that the first phase of the project has been completed this is considered to form part of the baseline conditions. The extension of the plant is not therefore expected to result in any significant cumulative impacts in combination with the Solar PV project.

No other 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. 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.

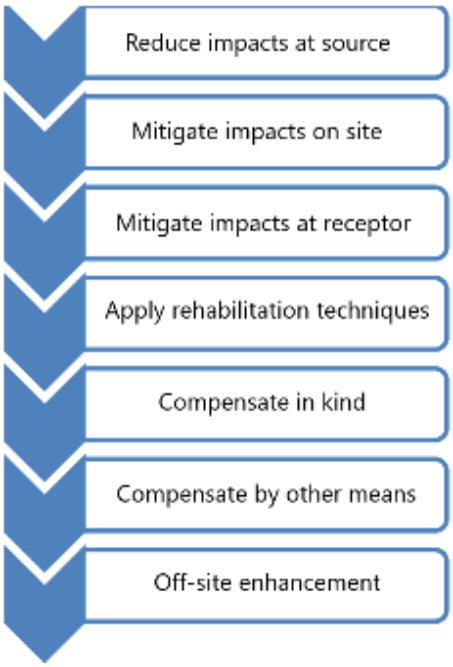

Figure 4-2. Mitigation hierarchy

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;
- 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;
- 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 will be carried forward and further developed into 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) was 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 ongoing 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 Scoping Phase

Spanish consulting firm TYPSA undertook the Scoping Study for the current Project in September - 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

Stakeholders were consulted either via videoconference or face-to-face during the site visit. Stakeholders consulted via videoconference were predominantly institutional stakeholders who had reliable access to a computer and the internet and therefore could easily participate in this manner. All stakeholders attended one meeting held on 8th September 2020. Stakeholders who attended included representatives from the following institutions:

- Ministry of Energy – Head of Renewable Resources Department
- Ministry of Energy – Social Specialist
- Samarkand Region – Deputy Head of Cadastre Department
- Kattakurgan District - Deputy Khokim
- Kattakurgan District – Deputy Head of Cadastre Department
- Kattakurgan District - Head of Construction Department
- Kattakurgan District – Head of Forestry Department
- Kattakurgan District – Head of Water Resources Management Department

- Kattakurgan District – Head of Employment Department
- Kattakurgan District – Deputy Head of Department for Communications with Makhallas
- Chairman of Melikhudj Makhalla
- Chairman of Upka Makhalla
- Chairman of Bulakchi Makhalla
- Chairman of Damkhodza Makhalla
- Chairman of Partaabad Makhalla

Other stakeholders were engaged face-to-face during the scoping site visit which took place on 28th September 2020. Some of these stakeholders were community-level and therefore may not have had the resources required to participate in remote engagement methods (e.g. videoconferencing). Others were institutional stakeholders who participated in the site visit to facilitate a clear understanding of the project site and the environmental and social opportunities and constraints it presents. Stakeholders engaged with face-to-face during the site visit include:

- Deputy Khokim of Kattakurgan District on Investments
- Head of Environmental Department of Kattakurgan District
- Land Surveyor of Kattakurgan District
- Head of Land Cadastre Department of Kattakurgan District
- Deputy Head of Samarkand Region Cadastre Department
- Mulitple residents of Damhodja Makhalla
- Head of leasehold farm identified in Area 2 (see Section 6.7.5)

Additional phone conversations with affected farmers in Area 2 (Kosimov Abdullo Olmazori Farm) and Area 4 (Shomurod Nur Sakhovat Farm) (see Section 6.7.5) were also conducted during project scoping on 29th October 2020. The farmers confirmed that the Government has already taken action to acquire their land and to resettle them and provided details about their land and agricultural activities. The contents and findings of the consultation are presented in the land use section of the socio-economic baseline conditions description (see Section 6.7.5).

5.1.1.2 Outcomes

The outcomes of these engagement activities yielded an understanding and appreciation of local and regional environmental and social issues. Environmental issues identified and discussed during stakeholder consultations included:

- Groundwater on the project site is between 180 to 200 m below ground level (mbgl). There is a substation located near Ishtikhan, approximately 3 - 4 km from the site which has a well that is 150 m deep.
- The head of the water resources management department for Kattakurgan District advised that the best option to obtain water from construction and operations is to drill a well. The alternative option is to pump water from the canal located to the north, but it was advised that this would not be cost effective.
- The head of the water resources management department further advised that there are artesian wells located approximately 4 km from the project area and water data analysis for these wells, as well as other water resources in the district, is available and can be provided.
- There is a landfill site 30 km from the project area and sorting of wastes is performed in the landfill site. There are no licensed companies for removal of hazardous wastes, as there are no hazardous wastes generated in the project area and surroundings but there are companies engaged in removal of construction materials.
- The head of forestry department for Kattakugan District advised that there are no endangered species of birds and animals or protected areas within the project area.
- It was further clarified that the State committee for environment and its regional and district departments are responsible for natural protected areas.

Social issues identified and discussed during stakeholder consultations included:

- Some contradictory information on current land uses within and surrounding the project site came to light during the consultations:
- According to District authorities, there is no legal use of land, although some informal use for cattle grazing occurs in springtime.
- Some participants indicated that no structures had ever been present on the project site (as grazing would mostly take place 1.5-2km away).
- Whereas, representatives from the Cadastre Department of Kattakurgan District indicated that while there were structures made of light construction materials on the site these had been demolished after the official allocation of land for the project, when the local population was instructed to remove all structures from the project area, in accordance with the Decree of the Cabinet of Ministers No.416.
- However, during the scoping site visit there were still structures on the site, as described in Section 6.7.5.

The process for land acquisition and compensation was explained by the Kattakurgan District Cadastre Department:

- The tenure of agricultural land is based on long-term contracts between Khokimiyat and individual farmers. A specific clause in the contract regulates land acquisition for state needs.
- Based on the contract, compensation is paid unless it is proved that the land has not been used for agricultural purposes. If structures are present and legally registered, compensation is also paid. If there are crops on the land, compensation is paid for yield.
- Compensation is agreed only after the last crop cycle has been harvested. Agronomists of the District´s agricultural departments determine the amount of compensation based on crops productivity, market price, future yield, etc.
- Participants were shown a recent satellite image in which a well-developed farm and some structures were clearly present inside the project site. Kattakurgan District representatives stated that where there was a formal contract between the farmer and Khokimiyat, then compensation will be paid based on the contract.
- Where there is no formal contract IFC PS5 entitles informal settlers to assistance and compensation of assets. However, representatives from Kattakurgan District stated that usually, where structures are not residential and not official, compensation is not paid. There can be assistance, but through volunteers, aksakals (makhalla elderly leaders), and other unofficial assistance.
- The consulted authorities insisted that the land is not being used in any form.
- The presence of a drainage channel crossing through the northern end of the site was also discussed:
- Participants were shown images of the irrigation/drainage canal and authorities insisted that it was a naturally formed current and man-made irrigation infrastructure.
- According to local farmers consulted during the site visit, the channel currently serves as a drainage canal for polluted waters from irrigation of fields upstream. Local farmers also stated that their cattle drink this water without any consequence.
- Lastly, a burial site is visible in the north-east corner of the project site, but authorities claimed that the territory of the cemetery does not fall to the project area. The Chairman of nearby Makhalla also confirmed that this is correct.

5.1.2 ESIA

During the preparation of the ESIA a number of site visits were undertaken by the in-country project team which included some further stakeholder engagement activities. The site visit was conducted between 20th and 22nd September 2021. A further site visit was carried out late November 2021 by AECOM and the in-country team.

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 5-1.

Table 5-1. Stakeholder Groups Engaged During Site Visit

Stakeholder Group	Stakeholders
Local Government Representatives	• Deputy Khokim of Samarkand Region on Investments • Head of Industry development, Samarkand region Khokimiyat • Deputy Khokim on Investments of Kattakurgan District • Kadastr of Kattakurgan • Head of department on Investments, Kattakurgan Khokimiyat • Deputy Khokim on women and families, Kattakurgan Khokimiyat • Ecology department of Kattakurgan District
Community Organizations	• Women's Shelter, Kattakrgan District
Community Representatives	• Mahalla Chairs • Community leaders from Pasdargom District
Land Users	• Farmer affected by OTL • Area 1 Farmer • Area 2 Farmer • Area 3 Farmer • Area 4 Farmer • Farmer affected by OTL • Area 5 Farmer • Herder
Community Members	• Shurak and Melikhodja mahalla community members • Teachers from School №57
Individual Specialists / Academics	• Specialist on women's issues of Pasdargon District

•

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 were engaged with including farmers (Figure 5-1), community members (Figure 5-2), Mahalla leaders (Figure 5-3), and local government representatives (Figure 5-4). Notes were taken during each stakeholder meeting and key issues discussed. Further details of these consultations are provided in the Project SEP.

Figure 5-1. Meeting with Farmer 5 at his home

Figure 5-2. Shurak and Melikhodja mahalla community members

Figure 5-3. Meeting with Bogishamol mahalla leaders

Figure 5-4. Kattakurgan women deputy governor

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 5-2 describes the proposed timeline for the stakeholder engagement during further phases 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 5-2: Stakeholder Engagement Programme

Stakeholder Category	Stakeholder Engagement Methods	Location/ Timeline	Purpose	Consultation Disclosure Materials	Mean of Advance Notification	Respo
ESIA DISCLOSURE PHASE						
All stakeholder groups	Public meeting	Location/Date: Prior to construction (with exception of early works agreed with lenders)	• Disclose key finding of the ESIA, identified significant impacts and mitigation measures	Non-Technical Summary (NTS) of the ESIA online	• Media announcements • Website announcements	E&S Co from the
Mahalla Offices	• One-to-one meetings • Phone calls • Placement of paper versions of the ESIA in public places[20] • Placement of leaflets	Location/Date: Prior to construction (with exception of early works agreed with lenders)	• Arrange disclosure of the local ESIA package	Local ESIA package	• Personal interaction	E&S Co from the
All stakeholder groups	• Public presentations to summarise the ESIA • Placement of leaflets in public places • Media announcements	Location/Date: Prior to construction (with exception of early works agreed with lenders)	• Comply with the ESIA regulatory requirements • Disclose and discuss the results of the ESIA study	Local ESIA package NTS of the ESIA online	• Media announcements	Local au (with su Consulta
CONSTRUCTION PHASE						
All stakeholder groups	• Disclosure online • Placement of paper versions of the ESIA in public places • Leaflets in public places • Media announcements	Location/Date: [TBC]	• Disclose and discuss the construction status and any High 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 High events due to take place (component delivery for example).	Local ESIA package	• Personal interaction	Client
Local libraries	• One-to-one meetings • Phone calls	Location/Date: [TBC]	• Disclose and discuss the construction status and any High events due to take	Local ESIA package	• Personal interaction • Notice posted in public locations	Client

[20] 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 members 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 managed these issues as the project moves into the construction phase.

	• Placement of paper versions of the ESIA in public places**Error! Bookmark not defined.** • Placement of leaflets and grievance foms		place (component delivery for example). • Advertise potential job opportunities • Collect grievance/comment forms			
All stakeholder groups	• Public event • Placement of leaflets in public places • Media announcements	Location/Date: [TBC]	• Disclose and discuss the construction status and any High 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 Data Sources

The baseline description presented in this chapter has been developed based on the data from the initial Site investigation reports by TYPSA, the primary data collected through the AECOM site visits in September 2021 and November 2021, and supplementary secondary data.

6.1.1 Initial Site Investigations

The environmental and social scoping studies were carried out by TYPSA between December 2019 and November 2020 (TYPSA, 2020c); geotechnical and hydrological studies were completed by TYPSA in June 2020 (TYPSA, 2020a; TYPSA, 2020d).

6.1.2 ESIA Scoping Site Visit

The ESIA scoping Site visit was undertaken in September 2021 by the team from Green Business Innovation. The survey team consisted of biodiversity and socio-economics specialists. The Site visit involved a walkover of the Project Site, the area immediately surrounding the Site, and the proposed transmission line route. Observations included land use, flora and fauna. During the Site visit, the team also conducted a series of meetings and interviews with local authorities and residents.

6.1.3 ESIA Site Visit

The ESIA site visit was undertaken in November 2021 by the team from AECOM and Green Business Innovation. The survey team consisted of biodiversity and socio-economics specialists. The Site visit involved a walkover of the Project Site, the area immediately surrounding the Site, and the proposed transmission line route. Observations included land use, flora and fauna. During the Site visit, the team also conducted further meetings and interviews with local authorities and residents.

6.1.4 Additional Surveys

In addition to the surveys already conducted, AECOM have, or are in the process of, conducting further surveys and assessments. The surveys are:

- Social Compliance Audit (ongoing)
- Livelihood Restoration Plan (ongoing)

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6.2 Physical Characteristics

6.2.1 Climate and Meteorology

The project site is located in the Zarafshan River Valley which has a semi-arid climate with warm dry summers and cold winters. Table 6-1 provides monthly climate data averages between 1915-2003. The average annual precipitation in Samarkand between 1891–2000 was 339.3 mm. Most of the precipitation (70–90%) occurs in the winter and spring. In summer rainfall is rarely observed. Average air temperature in Samarkand (between 1991–2021) is 14.7°C, with the coldest month being January (average air temperature 0°C) and the warmest being July (average air temperature 27.63°C) (NOAA, 2021). Absolute minimal air temperatures reach -20°C and maximal air temperatures reaching upwards of 41°C (NOAA, 2021).

Table 6-1. Average monthly statistics of air temperature, precipitation, relative humidity, evaporation and average wind speed

Parameter	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Set.	Oct.	Nov.	Dec.	Year
Temperature(°C)	0.00	2.41	7.46	14.30	20.07	25.29	27.63	25.62	19.87	12.78	6.39	1.97	13.7
Precipitation (mm)	46.8	44.4	67.6	56.1	26.8	4.4	1.3	0.3	2.0	13.6	25.2	41.4	330.0
Relative humidity (%)	80	77	76	67	54	38	34	36	39	52	66	80	58.25
Evaporation (mm)	30	20	16	33	110	200	254	223	142	75	54	43	1200
Average wind velocity (m/s)	2.1	2.7	2.8	2.8	2.6	2.4	2.5	2.1	2	1.8	2	1.9	2.3

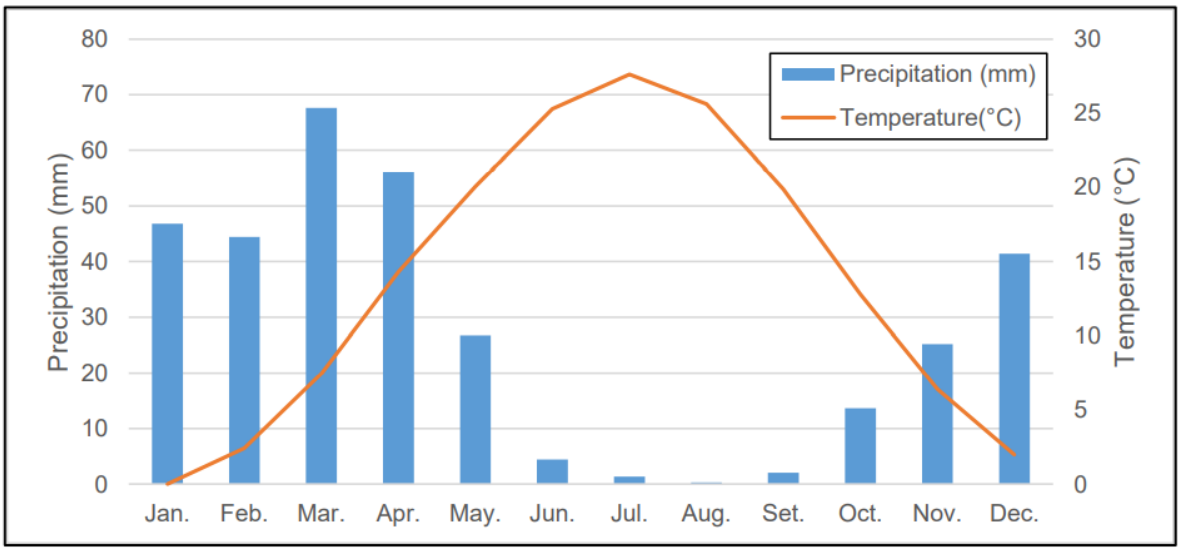

Figure 6-1: Average monthly precipitation and temperature variability at the Project Site

Source: TYPSA, 2020a

6.2.1.1 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 6-2 (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, 2016).

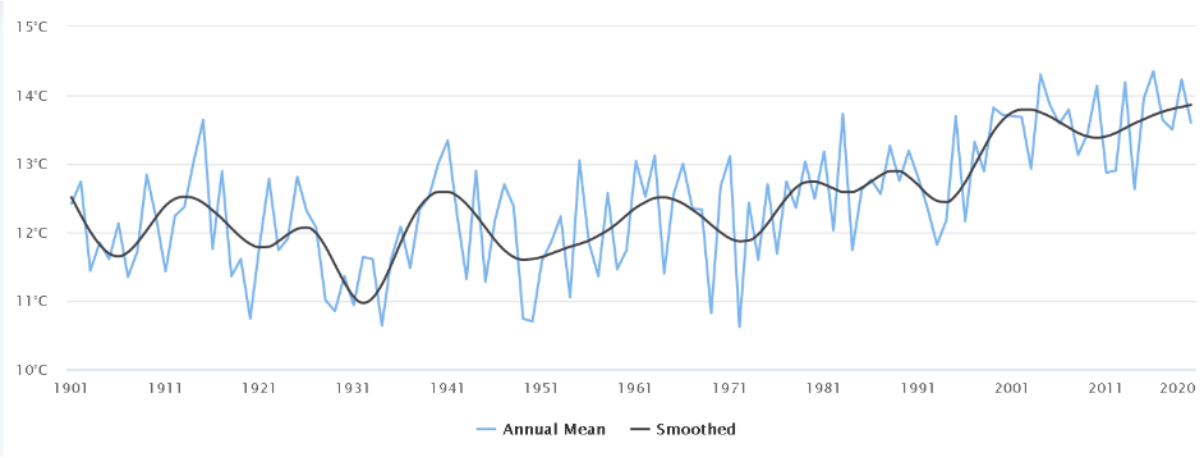

Figure 6-2. Observed Average Annual Temperature of Uzbekistan from 1901-2020

Source: World Bank Group, 2021

Climate change is expected to produce increases in monthly maximum temperatures across Uzbekistan. Figure 6-3 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 Group, 2021). 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 Group, 2021). 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.

With regard to precipitation, 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 Group, 2021). 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 Group, 2021).

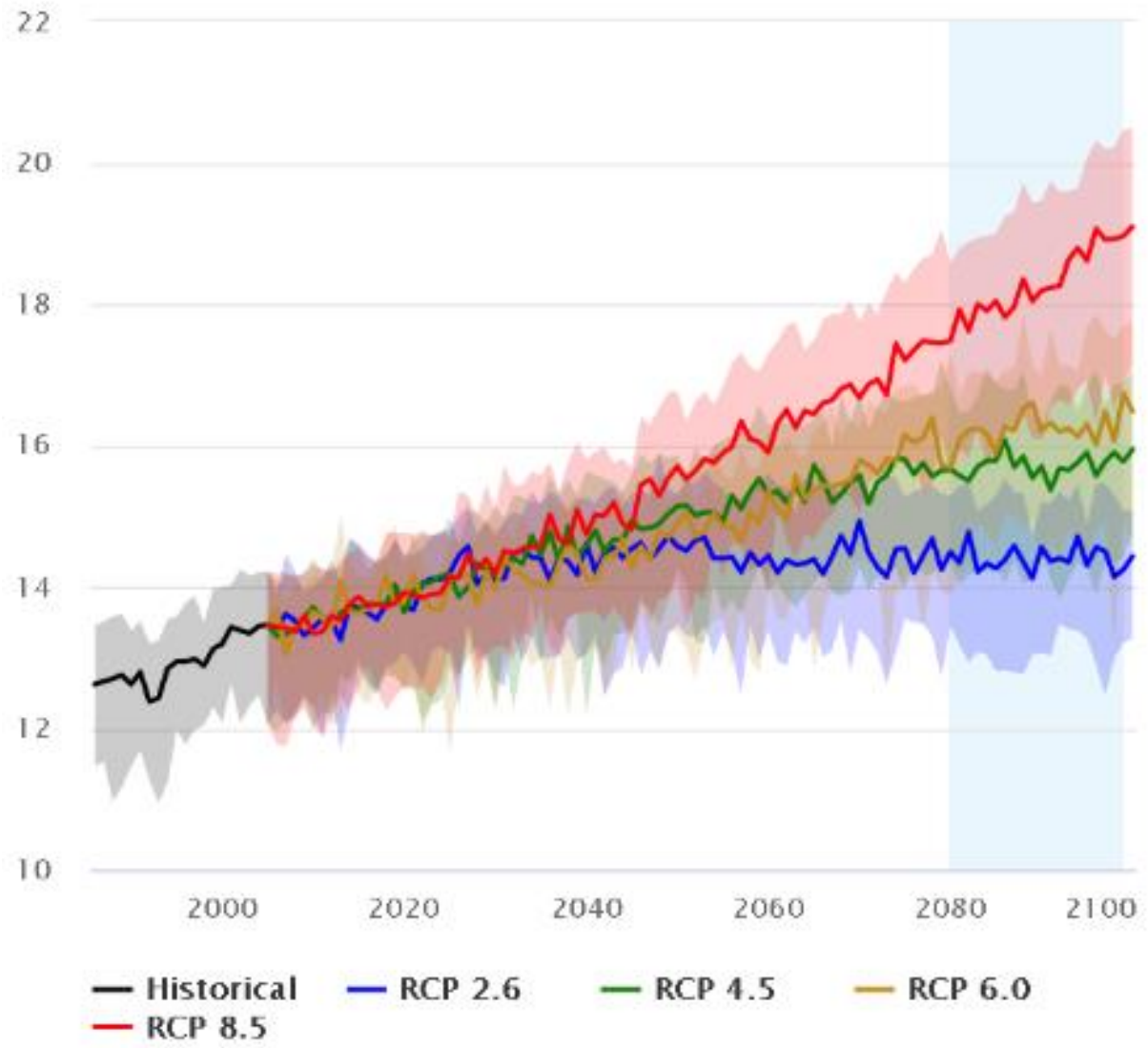

Figure 6-3. Projected mean-temperature in Uzbekistan from 1986-2100 under different emissions scenarios

6.2.2 Topography

The topography in the project area is slightly hilly and inclines gently towards the Zarafshan river valley. The surface is densely indented by canyon-like deep gullies, irrigation canals and ravines. The surface elevation of the project site varies from 535.5 to 582.5 m (unknown datum). The main water course in the area is the Zarafshan River, located approximately 3 km to the north. The project site is also crossed by numerous ditches and temporary watercourses.

6.2.3 Geology and Soils

6.2.3.1 Overview

Geomorphologically, the project is confined to the diluvial-proluvial clay deposits of the Tashkent complex (d-pQ_{II}^{ts}), undulating loess plain and is located within the IV left-bank above-floodplain erosional terrace of the Zarafshan River, formed during the Tashkent cycle of sedimentation.

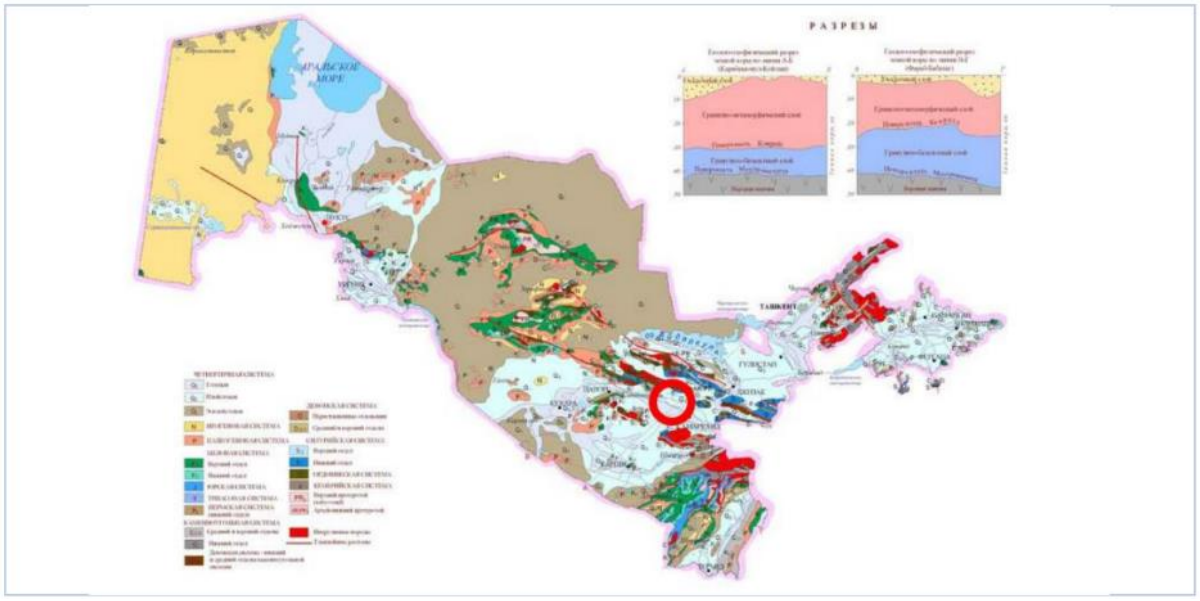

Figure 6-4. Kattakurgan solar plant in geological context of Uzbekistan

6.2.3.2 Local Geology

The ground at the project site is mainly composed by tertiary sands, with variable proportions of clay. According to the borehole data from geotechnical investigations, cenozoic formations are present in the geological structure of the site to an explored depth of 15.0 m. These formations are represented by mid-Quaternary diluvial-proluvial clay deposits of the Tashkent complex (d-pQ_{II}^{ts}). Clay soils are represented by loams, less often sandy loams, loess-like, light brown and macroporous, without inclusions of clastic material. A ground vegetation layer is developed overlying the clay deposits.

Of the modern physical and geological phenomena at the site, gully formation processes are observed; in the spring, mudflows may pass along the channels of dry riverbeds. Satellite imagery such as that of Figure 6-5 shows that there have been deep gullies towards the north of the site since 1980; although subsequent images such as Figure 6-6 indicate that these gullies are not growing towards the study area (TYPSA, 2020a).

The geotechnical investigations describe the topsoil at the site as follows: the first surficial 0 to 20 cm of the soil consists of a top vegetative soil layer that extends throughout the site. Its composition is very similar to that of the underlying sandy loams with inclusion of land waste and rubble, roots of plants, which results from weathering and organic activity. The next 15 meters are characterized by loams, sandy loams, loess-like, light brown, solid, highly porous, from weakly subsiding to highly subsiding, without inclusions of clastic material, non-saline (boreholes were drilled to a depth of 15m from surface).

Figure 6-5 Aerial picture of the gullies on the North side of Samarkand.

Source: TYPSA, 2020a

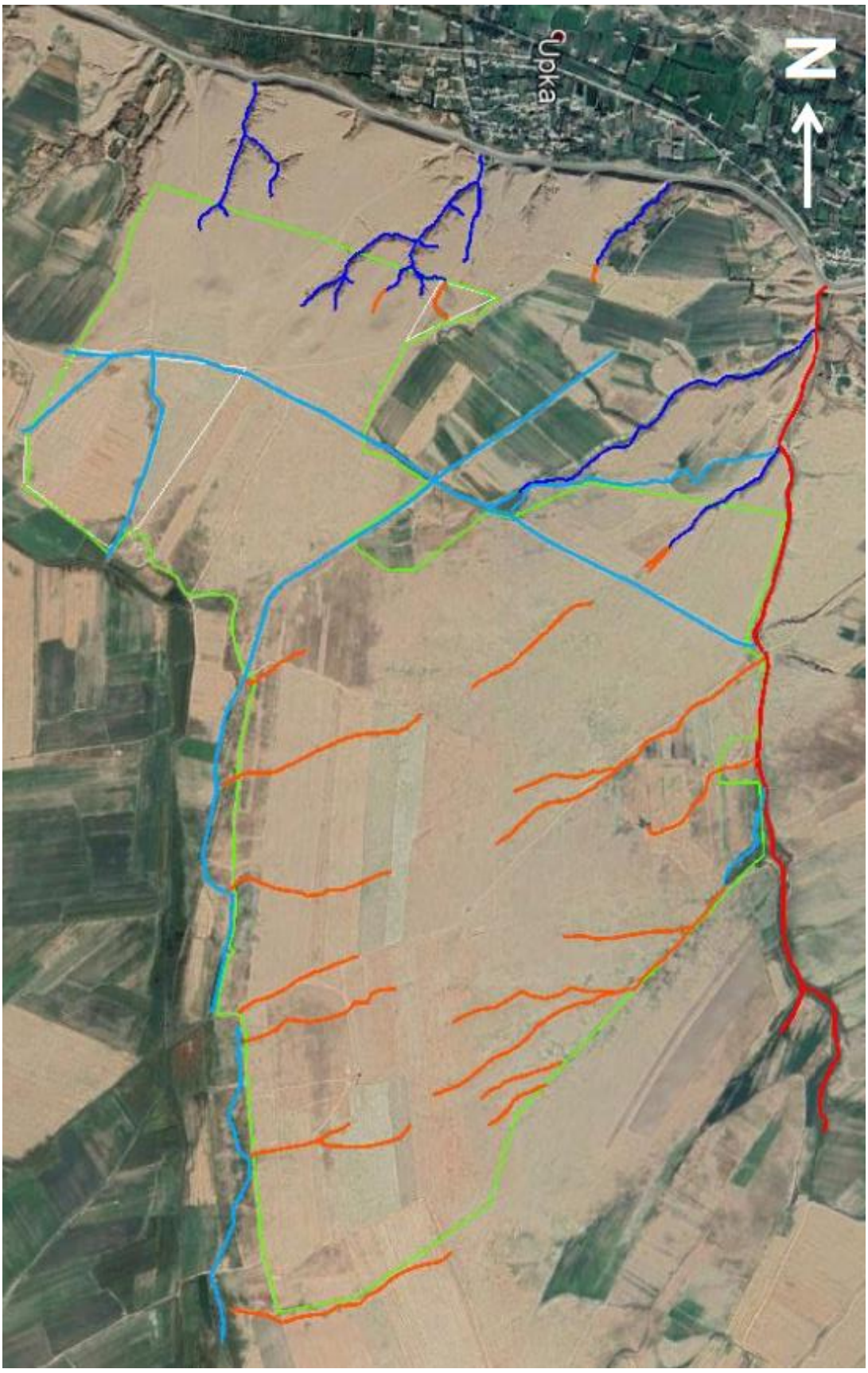

Figure 6-6 Deep gullies (blue lines), drainage ditches (light blues lines), gullies with depths less than 1.50 meters (orange lines) and a watercourse (red line).

Source: TYPSA, 2020a

6.2.3.3 Seismicity

Central Asia is a region of large crustal compression due to the collision of the Eurasian and Indian plates. The significant convergence and crustal shortening causes deformation resulting in many high magnitude earthquakes throughout the region, including eastern Uzbekistan, illustrated by Figure 6-7.

In parts of Uzbekistan, there are several seismically active zones; their directions coincide with large tectonic deformation strike lines, capable of generating earthquakes with a magnitude of M ≥ 5, called internal zones. With that said, the project site is not considered the most seismically active region of the country.

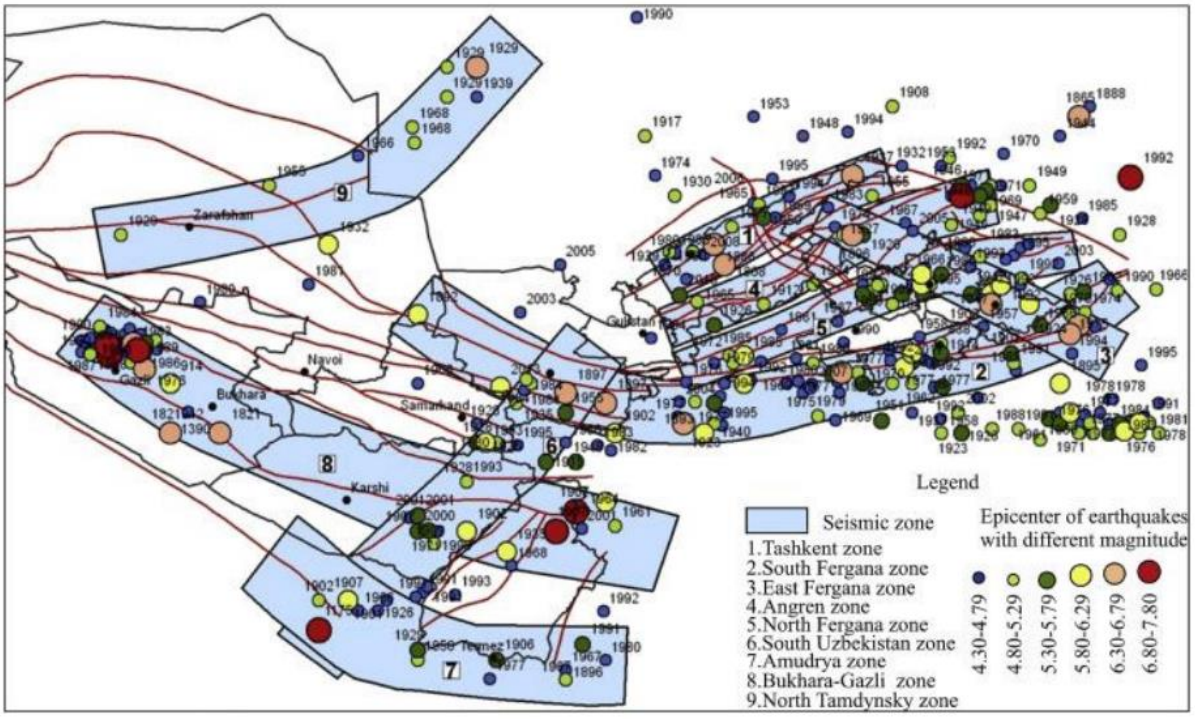

Figure 6-7. Map of earthquake epicentres in Uzbekistan and neighbouring countries

Source: Artikov, 2015.

6.2.4 Hydrology and hydrogeology

6.2.4.1 Regional

The water bodies in close proximity to the proposed site are:

- Zarafshan River – ~3 km North of the proposed site
- Zarafshan lead canal – ~2.5 km North of the proposed site
- Kattakugan Reservoir – ~15 km West of the proposed site
- Akdaryinskoe Reservoir – ~15 km North of the proposed site

The main source of surface water in the Samarkand area is the Zarafshan River, the third largest river of Uzbekistan. The Zarafshan River is a transboundary river that flows westward from the Zarafshan glacier in Tajikistan, through Uzbekistan, past Samarkand and through the Katta-Kurgan valley. The river then ceases in the desert near to the Amu Darya. The total river basin covers an area of 4,000 km^2 and the river length is 781 km. The Zarafshan River has no High contributing tributaries. The Zarafshan Valley is home to more than 7 million people and their only source of water is the Zarafshan river. The population faces water scarcity throughout the year. Along the northern border of the Project site, there is a lead canal originating at the Zarafshan River and feeding the Kattakurgan water reservoir. The Katta-Kurgan reservoir is a source of irrigation water for the valley. Spring rainfall events cause short term flooding of the canals and temporary watercourses located on the Project site.

On entering Uzbekistan from Tajikistan, the annual river discharge is 5.3 km^3. Further downstream the discharge increases only to 5.5. km^3. Tajikistan at present utilizes only 0.3 km^3, i.e. 8% of the discharge. The rest of the water is used in Uzbekistan.

The river has a number of dams and barrages: Pervomai, Akdarin, Damkhodzhin, Narpai, Karmarin, Shafrikan, Kharkhur, Babkent, and many large and medium canals for irrigation and water supply. In the middle Zarafshan are situated the reservoirs Tudakul (22,000 ha), Kuyumazar (1,600 ha), and Shurkul (1,600 ha). There are also several reservoirs which contain highly saline water. Four lakes receive drainage water through collector canals: Dengizkul (25 000 ha), Karakyr (12 000 ha), Tuzgan (5,700 ha), and Shurgak (1,600 ha).

Figure 6-8. Zarafshan River North of the site

Source: AECOM, 2021.

6.2.4.2 Local

Surface water hydrology on site is dominated by historical and current irrigation practises. There is a small stream/wetland area on the eastern boundary of the site (Figure 6-9). There are a number of irrigation ditches and collectors on site which were used to irrigate the wheat crops and allow run-off to be collected and used for irrigation downstream (Figure 6-10).

Figure 6-9. Stream/wetland on eastern boundary

Figure 6-10. Collector (now unused) on north eastern part of site

It was identified that water was being pumped from the Zarafshan River or canal to the area surrounding the site for irrigation purposes. The water was transferred by pipeline before being discharged into the irrigation system. Irrigation channels that cross the site and are still in use will be culverted to allow continued use by nearby farmers whilst protecting from construction impacts.

Figure 6-11. Irrigation pipe likely from Zarafshan River or canal

Figure 6-12. Irrigation water discharging into the irrigation system

The area of land on the route of the transmission line is actively farmed and irrigated. The farmlands on the transmission line route are likely to experience some temporary disturbance during construction and some loss of land where pylon bases are located on their land. The LRP process is being finalised and those PAPs will be compensated through that process.

Figure 6-13. Farmland on transmission line route being irrigated

Figure 6-14. Farmland on transmission line route being irrigated (2)

Figure 6-15. Farmland on transmission line route being irrigated (3)

6.2.4.3 Water Quality

The water quality in the river has deteriorated in recent years due to the impact of the return water from irrigation and waste waters from Samarkand and Kattakurgan. Water salinity in the river increases from 0.27 g/l at its source to 2.4 g/l at its mouth (AECOM, 2021). The highest pollution level is downstream of the towns Kattakurgan and Navoi, and the maximum allowable levels of oil, phenols, copper, and pesticides are usually considerably exceeded (AECOM, 2021). It was reported during the site visits that surface water or agricultural run-off tends to be contaminated with fertilizer and pesticides. The river water is classified as having a medium level of pollution.

6.2.4.4 Groundwater

In the valley of the Zarafshan River, the groundwater is confined to alluvial-proluvial gravel formation with an aquifer thickness of up to 50 m. During the geotechnical investigations (15 m borehole), groundwater was not found (TYPSA, 2020a). Stakeholder meetings revealed that water supply is mainly from wells that are about 200 meters deep. The Ishtikhan substation, to which the project's transmission line will be connected to will be located 4.5 km from the project area, has artesian wells 150 m deep (TYPSA, 2020b).

6.2.4.5 Flood Risk

A full hydrologic and hydraulic study was carried out by TYPSA[21] and according to the available data there is low flooding risk in the site of the project related to extreme flows of the Zarafshan River (TYPSA, 2020a). This conclusion is consistent with the geographical information (distance and elevation difference between the project site and the river). Spring rainfall events cause short term flooding of the canals and temporary watercourses located on the Project site. This flow conveyance is often facilitated by the gullies near to the site which transfer rainfall to the temporary watercourses.

[21] Typsa, 2020. Hydrology and Hydraulic Report. Report SP6349-RP-HE-HyStd-D03 (14 Oct 2020)

6.2.4.6 Water Resources

In the Samarkand region the river water is used for irrigating 530,000 ha of land, mainly for agricultural products serving the immediate needs of the fast-growing country population (AECOM, 2021). On the north western edge of the site, a water pipe was recorded from the Zarafshan river (or potentially the canal) to irrigate the fields outside the permitter of the project site.

Figure 6-16. Water pipe from Zarafshan River (west of site)

Figure 6-17. Outflow of water pipe from Zarafshan River to irrigation system

There are two reservoirs in the area surrounding the project site: the Kattakurgan and the Akdaryinskoe Reservoir which are utilised heavily by the local population around the site. There is also a lead canal originating at the Zarafshan river which feeds the Kattakugan reservoir. A municipal water works is located in Samarkand but no assessment of the quality of the water has been carried out for this ESIA. No water pipes have been identified crossing over or adjacent to the site. To date the EPC Contractor has not confirmed the source of water they wish to use for the Project but will provide as part of detailed design.

6.2.5 Utilities

There are no known utilities passing through the Solar PV Site. The neighbouring villages are supplied by electricity and gas (see Section 6.7.7.3).

6.2.6 Air Quality

No routine air quality monitoring is carried out in the area although the site is located on an open rural area. Nearest national air quality monitoring stations are located in Samarkand, 60 km away, and are not considered representative of the air quality in the Project Area.

There are limited sources of air pollutants in the Project Area and this would be related to vehicles, the use of fuel for domestic purposes, and wind-blown dust from bare soil and unmade tracks.

The closest residential properties are 225m and 470m from the project boundary. AECOM are of the opinion that the limited sources of air emissions mean that dust is the issue to be managed and would be managed through appropriate construction practises. As a result AECOM do not propose to collect ambient air quality data.

6.2.7 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 livestock and human activities such as occasional cars passing by or through the Site. Nearest sources of light are associated with the nearby villages.

As noted above, the closest residential properties are 225m and 470m from the project boundary. AECOM are of the opinion that the limited sources of noise can be modelled and mitigated without the need for ambient noise measurements. As a result, AECOM do not propose to collect ambient noise data.

6.3 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.

6.3.1 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 the

study area has been defined by the zone of theoretical visibility (ZTV) analysis and professional judgement. 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.

6.3.1.1 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.

6.3.2 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 expansive views in all directions.

Key visual receptors are the nearby settlements to the north, west and east of the site boundary.

Figure 6-18. Site landscape, November 2021

6.3.3 Landscape character areas

Desk based analysis identified two Landscape Character Areas within the 10 km study area. These were verified as part of the site surveys. The description, key characteristics, likely trends and consideration of landscape value of each are detailed below. Project Landscape Character Areas are described in Table 6-2.

Table 6-2. Landscape character areas

LCA	Description
LCA1 Historic and current farmland	This is the LCA where the site is located. The LCA is a mix of small undulating landform with flat plateaus mainly used for grazing and historic arable cultivation. Irrigation channels and collectors are still present across the LCA. Visibility is limited within the more undulating parts of the LCA. In more open areas the view become more extensive particularly towards the south. The character of the landscape has been significantly altered by human activity during the Soviet era. The sensitivity is classed as Low.
LCA2 Zarafshan River and settlements	Like much of this region the LCA has been disturbed by human influences. The main features of this LCT are the main river valley, irrigation canals, built development, roads and bridges however much of this infrastructure has been in a state of decay for some years. There is little in the way of vertical features within this LCA other that overhead lines and pylons. Residential properties tend to be single storey with a small amount extending the two stories. As above, the character of the landscape has been significantly altered by human activity during the Soviet era. Overall the landscape value of LCA 02 is considered to be low.

Figure 6-19. View towards LCA1 from western side of the site

Figure 6-20. View from within LCA1 from centre of the site looking east

Figure 6-21. View from within the site looking northeast towards settlements of LCA2

Figure 6-22. View from within LCA2 Zarafshan River and settlements

6.3.4 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.
- Views from recreational/access routes and places of interest.

6.3.4.1 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 6-3. Viewpoint Descriptions

Viewpoint ID	Location	Representative Receptors	Description
Viewpoint 1	1 km west of the nearest part of the Project Site boundary	Farm access road and residential receptors	This viewpoint is representative of residents travelling from the villages to the west of the project site on the dirt road towards small farms close to the site. The VP edge of the settlement is at an elevation of approximately 980 m ASL and is approximately 20 m above the southern edge of the site. The northern part of the site is at an elevation of 950 m ASL. As a result, the views from VP1 are expansive. The only vertical features are trees and transmission towers associated with the settlements. As the viewer approaches the site, elevation decreases, and the views become screened by the undulated land form. In this area the farms and small buildings become the dominant feature of the view. Views become screened by small trees and shrubs. Overall, residents 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	750 m east of the nearest part of the Project Site boundary	Residential receptors	This viewpoint is representative of residents travelling from Damkhodzha to the east of the project site on the dirt road towards small farms close to the site and the cemetery. The VP edge of the settlement is at an elevation of approximately 555 m ASL and is approximately 10 m above the northern edge of the site. The central part of the site rises to an elevation of 580 m ASL. As a result, the

			views from VP2 are generally limited to the eastern half of the project area. The only vertical features are trees and transmission towers associated with the settlements. As the viewer approaches the site, elevation decreases, and the views become screened by the undulated land form. In this area the farms and small buildings become the dominant feature of the view. Views become screened by small trees and shrubs. As noted, views of residents will be partially restricted by the topography, therefore the visual value is considered to be low.
Viewpoint 3	400 m north of the closest part of the Project Site boundary	Residential receptor	The view, looking south towards the project, is representative of the small scattered properties to the immediate north of the project. The foreground is comprised of areas of cultivated ground, bounded by trees and shrubs. The dirt road is predominantly used by local residents for access purposes. A high degree of screening is provided by the earth wall on the edge of the road and the vegetation. Views are generally limited from this location. There is considerable screening provided by the existing vegetation and topography therefore the visual value is considered to be low.

6.3.4.2 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 6-4.

Table 6-4. 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 6-5.

Table 6-5. 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 receptors is summarised in Table 6-6.

Table 6-6. Project Landscape and Visual Receptor Sensitivity

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

6.4 Biodiversity

6.4.1 Introduction

The Project site (the Solar PV site and the 4.5km OHL) is located within an agricultural landscape adjacent to several rural settlements in the Zarafshan river basin.

The Solar PV site sits on flat and gently sloping cultivated land that mostly has been abandoned, but the area is densely indented by deep gullies, irrigation canals, ditches and temporary watercourses which have the potential to attract a wide range of species. The soils are light textured sierozems and are non-saline. Notably, the Zarafshan river is located approximately 2km from the northern boundary of the proposed Solar PV site.

The proposed OHL is routed through a generally flat, intensively cultivated and irrigated agricultural landscape, with field crops including cotton.

This section documents the ecological importance of the Project site and identifies species or habitats that may be subject to further mitigation during construction, operation and decommissioning of the Project.

6.4.1.1 Ecological Assessment – TYPSA/IFC

The ecological baseline is informed by ornithological surveys undertaken by TYPSA in 2020[22] and 2021[23].

6.4.1.2 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 are provided in Section 6.4.3 (field survey methodologies), Section 6.4.4 (details of consultations which were undertaken) and Section 6.4.5 (Ecological Baseline).

6.4.1.3 Ecological Assessment – Turnstone Ecology

A Critical Habitat Assessment (CHA) was prepared by Turnstone Ecology in 2022. The CHA was 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.

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.

[22] TYPSA/IFC (2020). Environmental and Social Scoping Report – Kattakurgan Solar PV Project . March 2020

[23] Typsa, 2021. Great Bustard Winter Survey – Kattakurgan Solar PV Project