Preliminary Environmental and Social Impact Assessment

100 MW Solar PV Plant by Navoi in Uzbekistan

Nur Navoi Solar FE LLC

19 June 2020

Quality information

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1. Introduction

Masdar (Masdar) has commissioned this Environmental and Social Impact Assessment (ESIA) Report for a proposed 100 megawatt (peak output) (MWp) solar photovoltaic (PV) power plant, known as Navoi Solar Park (the 'Project'), in the Navoi region of the Republic of Uzbekistan.

1.1 Overview of the Project

The Government of the Republic of Uzbekistan attaches great importance to the development of renewable energy projects. The country has very good solar resources which are suitable for the viable development of large-scale commercial solar plants. The development of the PV Plant is in-line with the national Economic Development Vision 2030. This project is Uzbekistan's first public-private partnership (PPP) solar project under the International Finance Corporation's (IFC) Scaling Solar program. Financing is expected to be completed in Q3 2020.The anticipated lifespan of the Project is approximately 25 years; however, the Developer may repower the project to extend its operational life. Following Project decommissioning the site will be reinstated back to the current land use (grazing land).

The proposed project site is located in the Navoi region, approximately 35 kilometres east of Navoi City, 16.2 kilometres west of Navoi International Airport, and 2.5 kilometres to the west of Uzumzor settlement. As noted, the land is currently used for rough grazing of livestock. At the time of the March 2020 site visit this consisted of sheep and goats although AECOM were informed that cattle would also be grazed on occasions. Previous attempts to cultivate arable crops were noted but it is important to note that a combination of poor soil quality and lack of water made this unviable. Based on discussions on site, attempts at arable cultivation were abandoned approximately 5 years ago.

The PV Plant will occupy approximately 267 hectares (2.6 km^2) of land and will be enclosed by a 2.5-meter-high fence. These features are demonstrated in Figure 1-1 with the plot boundaries shown in Figure 1-2. A view of the general site area is shown in Figure 2-1.

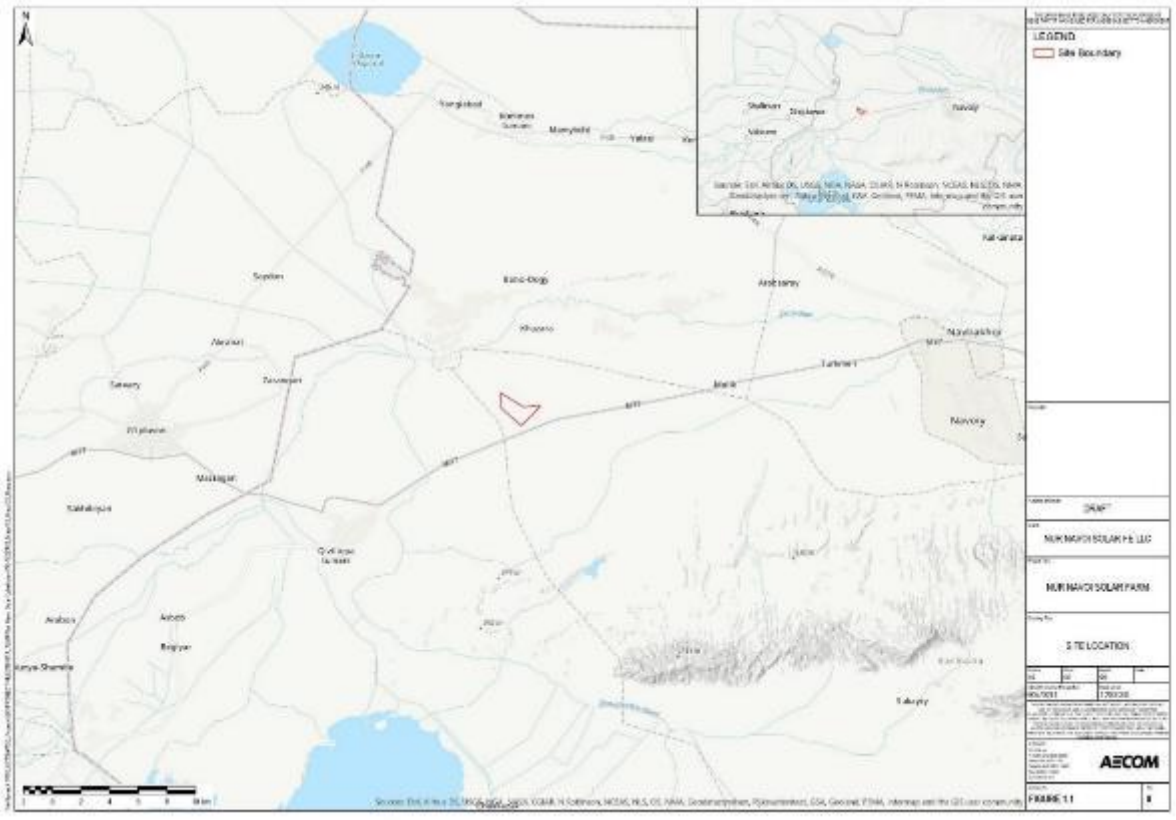

Figure 1-1: Project Geographical Location

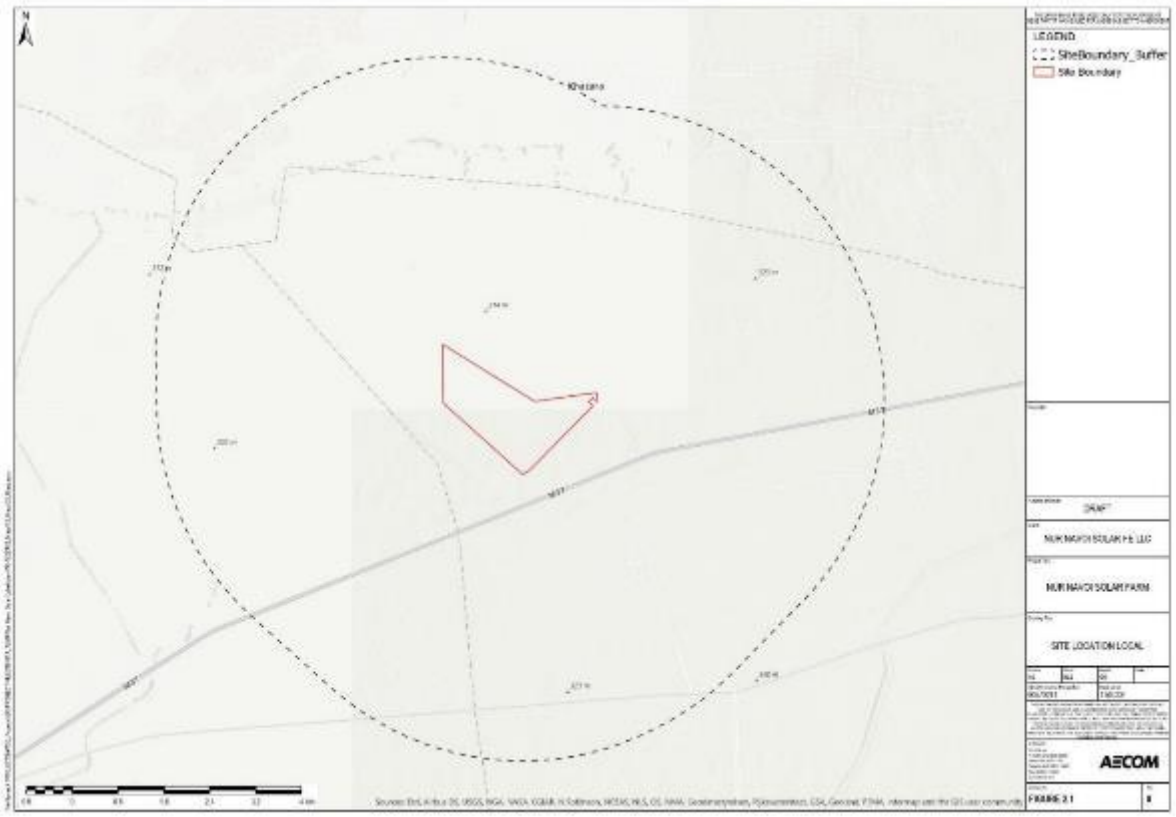

Figure 1-2: Project Site

Figure 1-3: View of the Project Site outside the NW boundary looking SE

1.2 Details of the Project Developer

1.2.1 Name of Company

Nur Navoi Solar FE LLC (the "Developer") is planning the development of a 100 MWp solar PV Power Plant (the "PV Plant") located in the Navoi region in the Republic of Uzbekistan (the "Project"). The Developer has signed a Power Purchase Agreement (PPA) with JSC National Electric Grid of Uzbekistan.

Nur Navoi Solar FE LLC is wholly owned by Masdar, a global leader in renewable energy and sustainable urban development. 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.

Headquartered in Abu Dhabi, Masdar develop renewable energy projects, realise low-carbon urban development and advance clean-tech innovation. We also deliver world-class knowledge and industry platforms.

At Masdar, we are supporting the UAE's transition towards a knowledge-based economy. We aim to be a model for the commercial adoption of clean technologies, and a showcase of the UAE's wider commitment to sustainability.

1.3 Preliminary Report Structure

This Preliminary ESIA report has been developed following good international practice and comprises the following sections as outlined in Table 1-1. The purpose of the Preliminary report is to carry out an initial assessment of impacts based on existing information, supplemented with additional surveys. The Preliminary report will also identify the type and extend of further studies required. The full ESIA will follow the same structure but will also include an assessment of residual impacts. Further site surveys will be carried out when circumstances allow as part of the full ESIA. The final ESIA, mitigation protocols and ESMMP will be prepared following the completion of additional studies.

Table 1-1: Preliminary ESIA Report Structure

Chapter	Contents
1. Introduction (this chapter)	An overview of the Project, purpose and structure of the ESIA 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 that are pertinent to the ESIA.
3. Legal and Policy Framework	Summary of the key national legislation and regulations in the sphere of environment and social aspects applicable to the Project, pertinent international conventions, standards and guidelines.
4. Assessment Methodology	Description of the methodology used to determine sensitivity, magnitude and significance of impacts.
5. Environmental and Social Baseline	Description of environmental and social baseline conditions, including physical environment, habitats, flora and fauna, local socio-economic conditions.
6. Initial Impact Assessment	Description of the individual impacts particularly those that will require further mitigation to be developed.
7. Mitigation and Enhancement Measures	Description of the required mitigation measures to be implemented through the project ESMP. This is either site specific mitigation or general adherence to good international industry practice.
8. Summary and Recommendations	Overall summary of the project ESIA and any key impacts or mitigation that should be implemented.

2. Project Description

The Project will consist of a Solar PV Power Plant covering a maximum area of 267 ha with a capacity of 100 MWp. It will be connected to an existing 220 kV overhead line adjacent and parallel to the southeast boundary of the proposed site. Any interconnections to the grid will be constructed within the proposed boundary.

2.1 Project Location

The proposed project site is located in the Navoi region, approximately 35 kilometres east of Navoi City, 16.2 kilometres west of Navoi International Airport, and 2.5 kilometres to the west of Uzumzor settlement. The location of the site is shown in Figure 1-1 and Figure 1-2. A view of the centre of the site is shown in Figure 2-1. The site is generally flat with few features of interest.

Figure 2-1: General View of the Centre of the Project Site

As noted, the land is currently used for rough grazing of livestock. At the time of the March 2020 site visit this consisted of sheep and goats although AECOM were informed that cattle would also be grazed on occasions (Figure 2-2).

Figure 2-2: Grazing taking place on site

Previous attempts to cultivate arable crops were noted but it is important to note that a combination of poor soil quality and lack of water made this unviable. Based on discussions on site, attempts at arable cultivation were abandoned approximately 5 years ago. The condition of irrigation ditches and culverts confirm that these areas are no longer in active use (Figure 2-3, Figure 2-4, Figure 2-5).

Figure 2-3: Previously cultivated area (outside site boundary)

Figure 2-4: Irrigation ditch no longer in use

Figure 2-5: Culvert on irrigation ditch no longer in use

The proposed site for the development is located adjacent to a secondary road that connects with a national highway (M37) (Figure 2-6). The development will access the site via a short length of existing secondary road (Figure 2-7).

Figure 2-6: M37 Highway Adjacent to the Site

Figure 2-7: Site access from the M37 Highway

Two farms are located in the northern (Figure 2-8) and southern (Figure 2-9) boundaries of the site, and the closest identified residential areas are the village of Uzumzor (~600 inhabitants), located approximately 2.6 km east from the boundary of the site, and a small village-sized cluster (~100 inhabitants) of residential properties approximately 2.2 km south.

Figure 2-8: Farm to the north of the Site (uninhabited at the time of site visit)

Figure 2-9: Farm to the south of the Site (inhabited at the time of site visit)

The natural drainage of the site is slightly inclined towards the west and is not envisaged to be modified. The site area is bordered on the west and east by two drainage channels, also referred to as collectors (Figure 2-10 and Figure 2-11). The intended purpose of these collectors is to capture and channel unused irrigation water back to the Zarafshan River.

Figure 2-10: Drainage channel (collector) on eastern boundary of site

Figure 2-11: Drainage channel (collector) on western boundary of site

2.2 Overview of 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 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 a process known as degradation. The degradation rate depends on the environmental conditions and the technology of the module.

Modules are either mounted on fixed-angle frames or on suntracking 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. Tracking frames are proposed for the Project.

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

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 2-12 shows the key principles and associated structures of this PV facility.

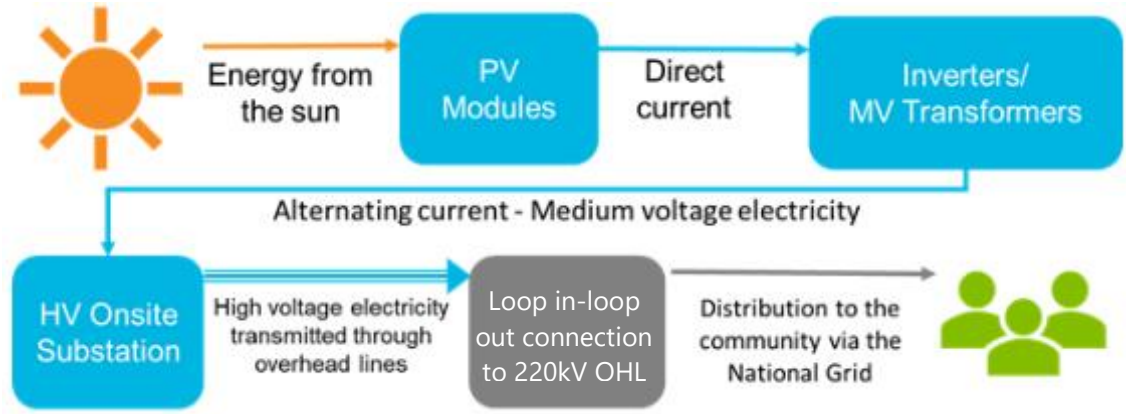

Figure 2-12: PV Power Plant Overview

2.3 Description of Key Design Components

The 100 MWp power generation plant is designed to use solar PV technology, where solar modules/panels made from silicon material are used to convert sun rays (solar energy) into electricity. The proposed plant is a medium size utility grade grid-connected solar-PV power system consisting of Photovoltaic modules/panels, MPPT solar power inverters, power conditioning units, 220 kV step-up power transformers and grid connection equipment. The plant will feed power directly into the grid with no batteries employed.

The ESIA has been undertaken assuming East-West Single Axis Tracker (+/- 55 degrees) mounting structures. Tracking systems require additional space and are technically more complex compared with fixed mounting structures and consequently, consequently assuming a tracking mounting system ensures the assessment is based on the realistic worst case. Any change to this design will therefore result in an impact that is of equal or lower magnitude than that assessed herein.

The view of a typical PV facility is shown in Figure 2-13.

Figure 2-13: Typical PV Facility, using Tracking System

Source: National Technology and Engineering Solutions of Sandia, LLC. (2018)

Table 2-1 provides a summary of the key Project components. Such information is based on preliminary information and design provided by Nur Navoi.

Table 2-1: Key Project Components

Component	Parameters
Inverter units:	659 x SUN2000-185KTL-H1
No. PV Modules:	328,750 x bifacial modules (manufacturer and model still under discussion)
Total DC kWp:	TBC
Total Export Act. Power (kW):	100,000 kW @ 50°C
Tracker Configuration:	Nclave SP160 +-55° E-W Single Axis Tracker
Pitch (Centre to Centre Substructure Spacing)	8 m
Site boundary area:	267 ha
PV Plant area	
PV Plant perimeter	

2.3.1 PV Power Plant Layout

The proposed layout of the Project is shown in Figure 2-14. The detailed plan is also provided in Appendix A.

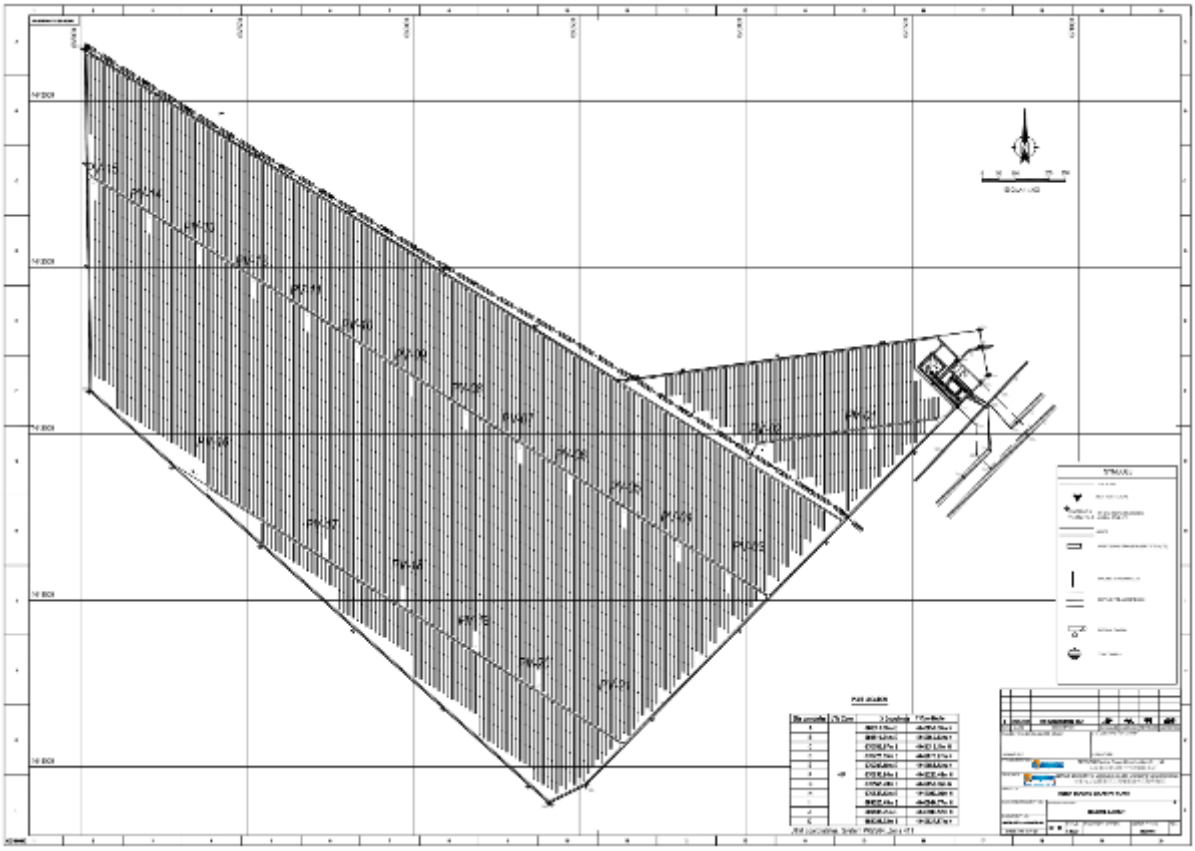

Figure 2-14: PV Power Plant Layout

2.3.2 Photovoltaic Modules

Photovoltaic (PV) cell technologies are broadly categorised as either crystalline silicon or thin film:

- **Crystalline Silicon (c-Si):** Crystalline silicon cells provide relatively high efficiency modules. Modules are made from cells of either monocrystalline or multicrystalline silicon. Monocrystalline silicon cells are generally slightly more efficient, but are also costlier than multicrystalline.
- **Thin Film:** Thin film modules are less efficient at peak levels than crystalline modules; however, they can provide performance advantages at varying irradiance and temperature conditions. Modules are made with a thin film deposition of a semiconductor onto a substrate.

In this instance, crystalline technology has been chosen for the Project site due to the high irradiance experienced at the site and the fact that such technology is likely to deliver higher efficiency under such conditions. 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. Tracking systems can either be single-axis or dual-axis (Figure 2-15). Single axis systems are typically mounted on a single vertical stand and rotate around the horizontal axis which follows the sun as it moves east to west. Dual-axis systems move both around the horizontal and vertical axes, therefore typically requiring a table style mount.

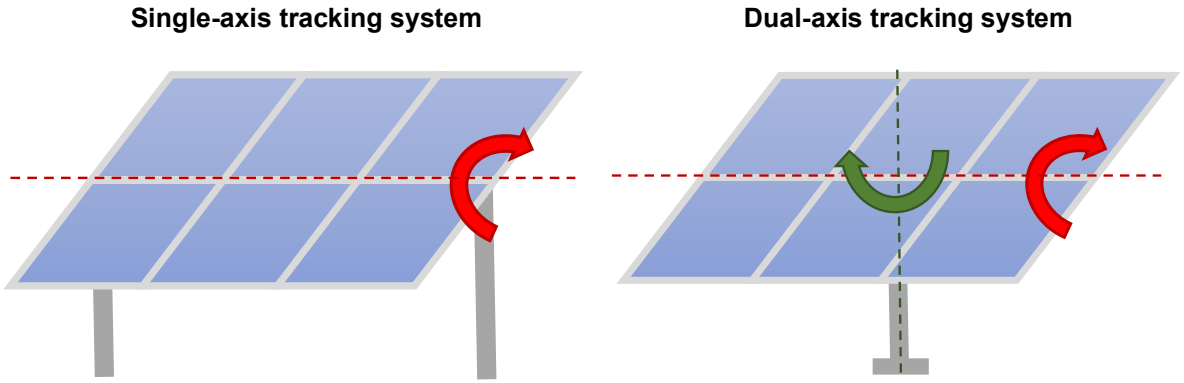

Figure 2-15: Schematic Diagram of Single- and Double-Axis Tracking Systems

2.3.3 Mount Foundations

The foundation design will comprise either galvanised driven piles, ground screw piles, or concrete foundations. These designs are illustrated in Figure 2-16. 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 of one option over the others depends on the substrate characteristics (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. However, based on the findings of the ground investigation work, piled foundations are deemed appropriate.

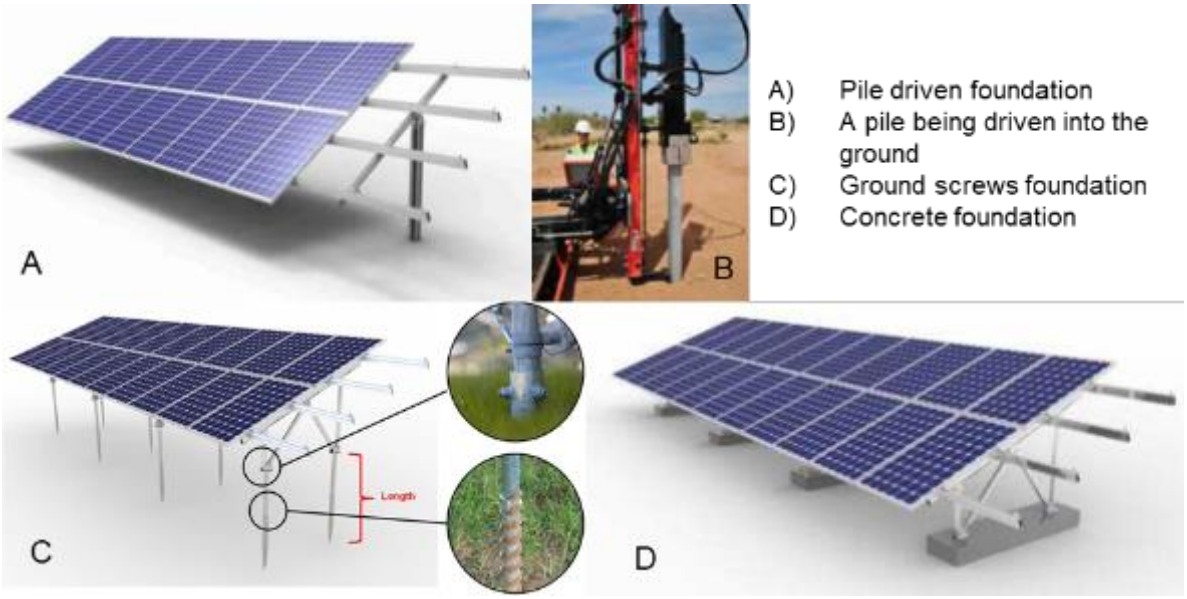

Figure 2-16: Foundation Options

Source: (ILF Consulting Engineers, 2019)

2.3.4 Solar Inverter, Switchgear, and Transformers

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.

There are two broad classes of inverters, central inverters and string inverters. Nur Navoi will install string invertors during the construction of the Solar Project. Each inverter has a footprint of approximately 1.6 m by 2.8 m and 2.5 m tall. The layout concept and a typical centralised inverter are illustrated in Figure 2-17.

The string inverter concept uses multiple inverters for multiple strings of modules, with inverter capacities in the region of approximately 15 to 30 kVA when used on large-scale PV plants. String inverters provide MPPT on a string or dual-string level with all strings being independent of each other.

This is useful in cases where modules cannot be installed with the same orientation, where modules of different specifications are being used, or when there are shading issues.

Up to 659 small units will be located on the site to house the inverters and transformers. These are used to convert the electricity generated by the panels to grid quality AC power.

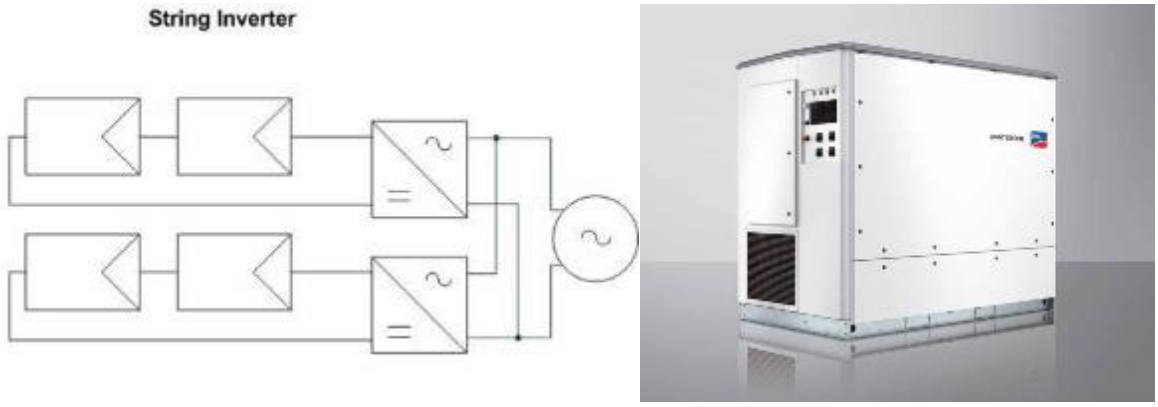

Figure 2-17: String Inverter Connection Concept (right) and Exterior.

Source: (ILF Consulting Engineers, 2019; SMA Solar Technology AG)

2.3.5 Cabling

Direct current string cables, connecting several strings to a combiner box, will run along the backside 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, typically buried up to 1.5 m below ground and in a 300 to 500 mm width trench.

The main AC cables will connect the onsite substation (Section 2.3.6) to the existing overhead line. The main AC cables will be routed as a separate overhead line.

2.3.6 Transformers

A transformer would typically comprise of the components illustrated on Figure 2-18.

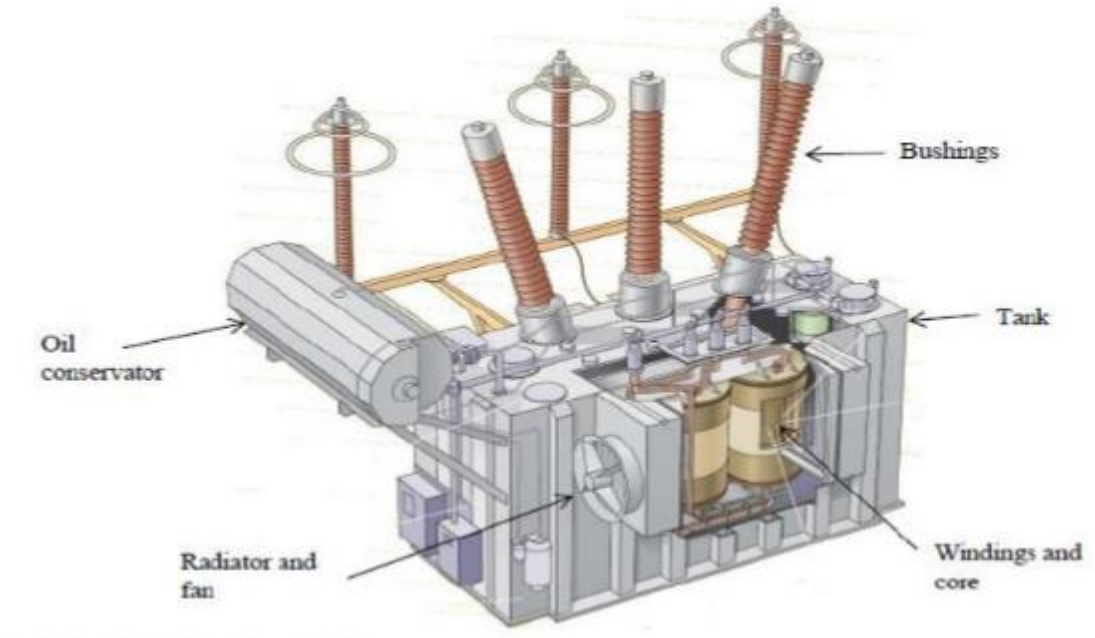

Figure 2-18: Major Components of a Liquid-Immersed Power Transformer

The transformers found in solar applications vary significantly in their characteristics. These are detailed further in Table 2-2.

Table 2-2: Transformer Electrical Characteristics

Category	Electrical Characteristic
Type	Liquid filled or dry type
Nominal Voltage of HV Winding	Depends of the application but typical values include 11 kV, 22 kV, 33 kV, etc.
Nominal Voltage of LV Winding	Depends of the application but typical values include 400 V, 660 V, etc.
Capacity	Depends of the size of the inverter.
Frequency	50 Hz or 60 Hz
Number of Windings	Two or three windings
Short Circuit Impedance	10%
Cooling Method	ONAN, ONAF, OFAF, ODAF
Vector Group	Delta or star connection of windings (Yy, Dy, YNd)

2.3.7 Onsite Substation

The onsite electrical substation transforming medium voltage (MV, 33 kV) electricity produced by the inverters to high voltage (220 kV) electricity that can be accepted by the grid will be placed close to an existing overhead line to deliver the shortest route to connect the Project to the public grid. The substation will consist of electrical infrastructure such as the transformer, switchgear, and metering equipment. It is also expected to include a control building, comprising office space, and storage facilities, as well as operational monitoring and maintenance equipment.

The onsite substation will be located in the south of the site and will have a maximum footprint of up to 0.8 ha and height of up to 5 m tall (incorporating a basement floor in the design). A typical substation is illustrated in Figure 2-19.

Figure 2-19. Typical Substation

Source: McAlister (2017). Tsogttsetsi Substation, Mongolia.

2.3.8 Transport Infrastructure

The existing transportation network (a combination of road and rail) is well established in Navoi region. The site is located off highway M37 and is accessible through a new access track leading to the temporary construction compound. The highway is currently used by HGV traffic. It is not expected that any road widening would be required.

Short sections of the existing road off the M37 highway leading to the site entrance will be upgraded if necessary (e.g.levelling, and surfacing) to accommodate heavy construction vehicles and a new access road created to provide access to the site. This is in addition to roads within the site boundary and comprises an estimated length of <1 km. New access roads will be created by levelling, cut to 300 millimetres (mm) depth and filling using sub base and base gravel material.

Within the site boundary an internal road network (4 m wide, gravel base) will be constructed between the panel arrays to facilitate access during construction and for operational maintenance.

The source of material for road construction is still being investigated and will be assessed as part of the full ESIA. The geotechnical investigations carried out to date suggest that there is no suitable material available on site. Therefore, stone would need to be sourced from a nearby quarry.

2.3.9 Fencing and Security

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

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

Source: AECOM, 2019

2.3.10 Water Resources

2.3.10.1 Water use

The main water requirement during construction would be water for concrete production. We have assumed 0.2 m^3 of water for every 1 m^3 of concrete. An additional supply of potable water will be required for the workforce. The water requirement has been estimated as:

Table 2-3: Water Requirements during Construction

Item	Number	Concrete Requirement	Water Requirement
Inverter bases (1.6 x 2.8 x 0.5m)	659	50m^3	300m^3
Substation and office building	1	1,200m^3	240m^3
Allow 30% extra for waste/washdown	-	-	75m^3
General construction water needs	-	-	2,985m^3
Total Construction Water			**3,600m^3**
Water needs for workers	365[1]	-	10,658m^3
Total Potable Water			**10,658m^3**

Water requirements during operation and maintenance will be largely focused on panel cleaning. Wet cleaning requires 4 tonnes of water per MW_{DC} therefore 131.5MW_{DC} / 100MW_p requires 524 tonnes of water per cleaning cycle. It is assumed that cleaning would take place six times per annum therefore 3,144m^3 of water is required. In addition, back panel wet cleaning requires 131m3 per cleaning cycle. It is proposed that wet cleaning of the back panels would take place twice per annum, requiring 262m^3 of water.

The total water requirement for wet cleaning is estimated as 3,406m^3 per annum.

2.3.10.2 Surface Water Drainage

The detailed operational drainage design will be carried out pre-construction with the objective of ensuring that drainage of the land is maintained without affecting areas outside of the Project boundary. The design of the drainage systems will take account of the site topography and seasonal fluctuations in surface water runoff, such as during snowmelt.

A suitable drainage system will be designed to accommodate surface flow and divert it to the existing irrigation canals in the area that are currently fed by the existing drainage system onsite. The Project drainage system will ensure that runoff rates from the site remains at or less than current conditions.

2.3.11 Grid Connection

Electricity generated by the Project will be connected to the grid by means of:

- Construction of a 33/220kV step-up substation for Navoi Solar PV Power Plant with 220kV out-door (AIS) switchyard and a 33/230kV step-up main transformer.
- Construction of 220kV OHL from the new 220kV out-door (AIS) switchyard of Solar Power Plant to the existing Л-17-Б-1 or Л-17-Б-2 220kV OHL LILO type connection.
- Delivery point: newly built 220kV open switchyard. The limit is the line to PV Plant bay isolating switch, line side.

2.4 Overview of Project Construction and Commissioning Activities

The Project will entail a series of activities including:

a) The pre-construction phase will include carrying out land survey, power plant design review with reference to ESIA recommendations; planning for storm water drainage and containment, undertaking site preparation, manufacturing-procurement of items and transporting the required components and construction equipment to site.

b) The construction phase will include establishment of internal roads and upgrading external access roads; establishment of construction areas; construction of the solar arrays, substation

[1] Number of workers is a monthly average based on workforce requirements provided in Table 2-4

and other associated ancillary infrastructure (i.e. powerline for evacuation of electricity); and inter-connection of the solar plant substation to the national electricity utility grid.

c) The post-construction phase will include plant operation and maintenance, site remediation, clearance and deposition of debris off the site, restoration of areas where construction activities temporarily disturbed the environment, repairs and replacements of failed parts; and finally decommissioning the entire plant when the useful life of the facilities is over.

2.4.1 Construction Programme

The potential for harsher winter conditions on site present the key constraint to the construction of the PV power plant. Currently, the construction programme is planned to start in Q3 2020 and end in Q4 2021.

2.4.2 Pre-construction Phase

2.4.2.1 Conducting of Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to, a geotechnical survey, survey of land/cadastral survey, transmission line route survey, a site survey and confirmation of the micro-siting footprint for the solar-PV arrays, substation site and road servitudes.

2.4.2.2 Site Preparation and Grading

Site preparation activities will include clearance of vegetation for the establishment of internal access roads and at the footprint of each project component. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and/or spread on site.

It should be noted that solar-PV sites require the lack of obstruction from surrounding trees and buildings or other infrastructure; otherwise power production is reduced due to shadows on the solar modules. No trees were observed within the Project boundary butl large shrubs within the vicinity and very close proximity to solar panels will be removed to prevent any of these casting a shadow on the solar-PV modules.

2.4.3 Construction Phase

2.4.3.1 Establishment of Access Roads to the Site

The site is accessible via the M37 road and a short length of metalled road. The road joins the M37 at a point approximately 35 km west of Navoi city centre. The road from the M37 is in a poor condition in some locations and may be upgraded by the EPC Contractor if required.

At this stage, it is proposed to transport solar PV components over land from China to the location of the proposed Project: Further details are provided in Section 6.8.

2.4.3.2 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.

The storage of fuel for the on-site construction vehicles and equipment will be secured in a temporary bundled facility to prevent the possibility of leakages and soil contamination. A dedicated area for the concrete batching plant will also be established. It is proposed that the facility will be located within the site boundary close to the site access from the local unmarked road.

2.4.3.3 Power Substation and Interconnection Facilities to the Utility Electricity Grid

A power substation including several power step-up transformers and switchgear will be constructed at site for stepping up power to 220 kV standard, as well as switching and power control mechanisms.

2.4.3.4 Workers Accommodation

It is AECOM's understanding that foreign workers may be accommodated in a worker's camp on site. If required, the camp will be fully designed in accordance with IFC/EBRD's Guide for Workers Accommodation.

It is recognised that a significant number of migrant workers will be employed in the construction phase. These workers will come from China or elsewhere in Uzbekistan. It is noted that there is likely to be sufficient hotel and guesthouse accommodation to accommodate the full workforce however the current Covid-19 restrictions dictate that a more managed approach is required to control the potential spread of the virus.

Secondly, from a social perspective, the local population are not likely to look favourably on a significant migrant workforce living in the local towns during a period when widespread restrictions are in place. It is important to consider how this will impact on the surrounding communities mainly during construction works. It is considered that the best way to control the potential spread of the coronavirus from the migrant workforce to the local population is to ensure the migrant workforce is separated from the wider population. Furthermore, Covid-19 management measures will be put in place and will be constantly under review.

It is noted that a workers' camp in the vicinity of the local communities may strain existing infrastructure, in particular the water and sanitation, electricity and transport systems. To ensure no such conflict, all required services will be available to the workers on site.

It is important to ensure good standards in living facilities in order to avoid safety hazards and to protect workers from diseases and/or illness, as well as to maintain a good level of morale. The exact location of the facilities has yet to be determined however the Khokimyiat has confirmed that additional land is available adjacent to the project site if required. The living quarters would therefore be sufficiently close that workers do not have to spend undue amounts of time travelling from their accommodation to the worksite.

Further details of the workers' accommodation will be provided when the EPC contractor is in place and will be reported in the Final ESIA report.

2.4.3.5 Water availability

Water required for construction purposes will be delivered to the Project site from Samarkand (to be confirmed) by means of trucks. However, the Project may seek to use groundwater for construction activities. During the operation phase, water for cleaning of panels will also be delivered to site. Should groundwater be used, a separate water treatment facility will be required to treat water to the required quality. It is noted that ground and surface water is not of potable quality.

Should the Project, at a later stage, decide to make use of groundwater at the site, the Proponent will be required to obtain a permit from the Khokimyiat to construct a borehole drilling programme for exploring for groundwater.

The option of groundwater development will be investigated further in the final ESIA. Should it be necessary, the Project/EPC will conduct a more detailed hydrogeological investigation including georesistivity investigation to identify potential well drilling locations.

2.4.3.6 Emergency and Safety Support Systems

Management of the Project 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 Project 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 using established safety procedures for power generation plants as guideline. 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.

2.4.4 Infrastructure Requirements during Construction of Power Plant

The Project will require additional infrastructure during construction works. It is anticipated that the following infrastructure and services will be required:

- If groundwater wells are installed then water pipelines and faucets at each solar array should be provided to allow wet cleaning activities.
- Temporary storage facilities for the new stocks of solar panels (for replacement purpose) and collection of damaged or broken panels on site.
- Effluent and storm-water drainage.
- Sanitation and sewerage disposal.
- On-site electricity supply (by means of diesel generator).
- Road access.
- Medical facilities on-site.

2.4.5 Operational Phase

2.4.5.1 General Plant Maintenance

To maintain the quality of the working environment, plant management will ensure good housekeeping and sanitation around the plant. Proper maintenance and servicing of all plant auxiliaries at all times will be supported with proper process documentation and data analysis on plant performance.

Solar array maintenance will involve removing overgrown grasses and shrubs within the solar array area that pose a risk of shading parts of the facilities.

2.4.6 Decommissioning Phase

The Project is expected to have an economic useful lifespan of approximately 25 years and the power plant infrastructure would either be decommissioned, extended or upgraded (if a new license is granted) once it has reached the end of its economic life. Upgrading the Project would consist of replacing old PV modules for new ones, increasing the total peak power of the plant (a process called “repowering”) or increasing the power of the plant by adding new elements such as trackers, PV modules or transformers.

If the Project is to be decommissioned, then the site will be returned to close to its original state. The components of a PV plant have an intrinsic value either for re-use or recycling. This value will cover the cost of decommissioning the plant and rehabilitating the site.

The following decommissioning activities will form part of the Project scope: site preparation and temporary storage; transportation and deposition of waste material. Essentially decommissioning will follow the construction process but in reverse.

The decommissioning or upgrading of the infrastructure has not been discussed in this ESIA report but will be addressed before decommissioning is required. If requested, a separate ESIA will be conducted prior to the time of decommissioning. In addition, any decommissioning activities and related plans will comply with the applicable national regulation.

2.4.6.1 Site Preparation and Temporary Storage

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment, mobilization of decommissioning equipment, planning for temporary and or permanent storage of debris.

2.4.6.2 Disassemble and or Replace Existing Components

The components would be disassembled, and reused and recycled (where possible), or disposed of in accordance with regulatory requirements. This would be done by sorting all materials, such that they are categorized into re-usable items and debris items.

All re-usable items shall be re-packaged into containers and taken to the market areas where they can be sold; while debris will be packaged into two types, one for hazardous materials and the other for regular debris.

Hazardous wastes will be disposed of in accordance with environmental guidelines required by the Khokimiyat; while the non-hazardous, like waste metals or plastics, will be delivered to respective re-cycling plants.

2.4.6.3 Site Remediation

Once decommissioning is completed, all equipment and debris shall be removed from the site and the affected area will be rehabilitated where practical and reasonable, back to the normal state of the environment. Site remediation methodology is included in the project environment management plan proposed for the development. The plan provides measures to mitigate/manage the potential impacts expected during the construction phase.

2.5 Project Staffing

The number of local people that are predicted to be employed during construction varies depending on the EPC Contractor however it is expected to reach a peak of 900 personnel. This includes technicians and low-skilled personnel (approximately 600) who will receive various levels of training before starting work on the project. This includes basic training on HSE, labour management and, where required for specific job profiles, vocational training.

The construction workforce is expected to consist of a combination of nationals and expatriate workers, with the majority being locals preferentially sourced from the surrounding towns and villages. The number of jobs to be made available to local women during construction has not yet been confirmed.

The total number of the local workforce is expected to increase as site preparation activities commence. After the peak level has been reached, the local workforce will gradually be reduced leading up to the start of operations.

The individuals employed during the construction stage, and their household members, will benefit from increased income that is likely to increase their overall standard of living, access to healthcare and educational resources, and reduce their socio-economic vulnerability. The project represents an opportunity for young people to increase their skills through vocational training that will be of use to them after their involvement in this project is completed. Individuals who receive such training should be able to seek alternative work within the growing construction sector in the future.

The number of local people that are to be employed by Nur Navoi during operation is expected to comprise of Uzbek nationals (men and women will be able to apply for these positions), in addition to personnel provided through local subcontractors to provide a range of supporting services, including security.

The following workforce requirements are anticipated for the project:

Table 2-4: Workforce Requirements

Dept.	Position	Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Home Office	Domestic Project Management	1	1	1	1	1	1	1	1	1	1	1	1

Dept.	Position	Month											
		1	2	3	4	5	6	7	8	9	10	11	12
	Design Management	1	1	1	1	1	1	1	1	1	1	1	1
	Procurement Centre	1	1	1	1	1	1	1	1	1	1	1	1
	Surveillance Dept.	1	1	1	1	1	1	1	1	1	1	1	1
	Integrated Logistic Dept	1	1	1	1	1	1	1	1	1	1	1	1
Site Project Management	Project Manager	1	1	1	1	1	1	1	1	1	1	1	1
	Project Chief Engineer	1	1	1	1	1	1	1	1	1	1	1	1
Site Project Commercial and Contract Department	Commercial Manager	1	1	1	1	1	1	1	1	1	1	1	1
Site Project Administrative Department	Admin. Manager	1	1	1	1	1	1	1	1	1	1	1	1
	HR Engineer	1	1	1	1	1	1	1	1	1	1	1	1
	Secretary(local)	1	1	1	1	1	1	1	1	1	1	1	1
	Driver (local)	1	1	1	2	2	2	2	2	2	2	2	2
Site Project Integrated Logistics Department	Integrated Logistics Manager	1	1	1	1	1	1	1	1	1	1	1	1
	Procurement Engineer		1	1	1	1	1	1	1	1	1	1	1
Site Project HSE Department	HSE Manager	1	1	1	1	1	1	1	1	1	1	1	1
Site Project QA/QC Department	QA&QC Manager	1	1	1	1	1	1	1	1	1	1	1	1
Site Project Financial Department	Financial Manager	1	1	1	1	1	1	1	1	1	1	1	1
Project Construction Department	Engineering Manager	1	1	1	1	1	1	1	1	1	1	1	1
	Civil Manager	1	1	1	1	1	1	1	1	1	1	1	1
	Civil Engineer (China)		1	1	2	3	3	3	3	3	2	1	1
	Civil Engineer (local)		1	1	1	1	1	1	1	1	1	1	1
	Elec. Manager	1	1	1	1	1	1	1	1	1	1	1	1
	Elec. Engineer (China)			1	1	1	3	3	3	3	2	2	2
	Elec. Engineer(local)			1	1	1	1	1	1	1	1	1	1
Subcontractor	Civil construction	50	50	50	90	156	226	460	581	581	455	165	50
	Electric construction				3	3	20	120	250	250	120	65	20
	Total subcontractor	50	50	50	93	159	246	580	831	831	575	230	70
CONTRACTOR Site staff	Site Management staff	14	17	19	21	22	30	30	40	40	22	21	21
Site Total	Site Total	83	89	93	140	208	305	639	900	900	624	277	117

2.6 Project Alternatives

The section below sets out the main alternatives considered during the site selection process and demonstrates the reasoning for the decision to take this Project site forward as the preferred development option.

2.6.1 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 and was adopted to ensure fulfilment of obligations under the Paris Agreement on climate change, as well as the implementation of the Action Strategy for five priority areas of development of the Republic of Uzbekistan in 2017-2021. Priority areas envisage the implementation of measures in various sectors of economy, including electricity, heat, oil and gas, renewable energy, construction and transportation.

2.6.2 Without the Project

Uzbekistan is one of the few countries which are fully self-sufficient in energy resources. It is the second largest of the Caspian gas producers (after Turkmenistan) and its abundant natural gas resources are used both for domestic consumption and export.[2]

Oil and natural gas comprise 97% of the country's energy balance. Primary energy shares consist of 86.3% gas, 1.9% hydro, 2.5% coal and peat, and 9.3% crude oil.

Uzbekistan is the largest electricity producer in Central Asia. Total national electricity capacity is 12.6 GW (as of 2007), of which 88.5% is provided by thermal power plants and 11.5% by hydropower plants.

100% of the population have access to electricity, but electrical supply to rural areas is unreliable and of low quality. There are often power blackouts that last many hours per day. Renovating the power transmission networks is one of the energy sectors priorities.

A 'without project alternative' would place ongoing reliance on generating additional power from fossil fuel sources and would fail to address Uzbekistan's Green Economy Strategy. A 'With Project Alternative' is therefore recommended.

2.6.3 Site Selection

In identifying a suitable site for solar energy developments, various elements need to be considered. These include factors such as:

- Solar resource.
- Environmental designations.
- Residential properties.
- Potential access.
- Grid connection.

The study has evaluated various project alternatives in terms of site for the Project, technology, 'without the project scenario' and grid connection options. The study found that although the 'without solar farm' alternative would maintain the status quo, which means that the current use of the site (livestock grazing) continues.

It should be noted that the site was presented to potential bidders by the Government of Uzbekistan in cooperation with IFC and as a result there was no opportunity for Nur Navoi to influence site selection.

2.6.4 Review of Site Considerations

The project site alternatives were screened by IFC based on availability of suitable land, access to the grid network, solar irradiation and project appraisal following the Lenders' requirements regarding environmental and social aspects. Based on these criteria, it is considered that the site has the following strengths:

- The site guarantees excellent solar irradiation.

[2] IEA (2009): World Energy Outlook.

- Availability of suitable land (not ecologically sensitive areas, no cultural heritage and archaeological feature, relatively flat, no flood risk, simple access and the willingness of the landowner to lease the land) and minimisation of impacts.
- In terms of technology, the conditions of the site are optimal for solar PV and unfavourable for other renewable technologies. The site does not possess sufficient wind resource and is not characterised by hydro or geothermal potential. Thermal power could potentially be the only technically suitable alternative, but its carbon footprint and the geographical location would make it both environmentally and economically disadvantageous. Secondly there is an operational coal fired power station, approximately 28km east of the Project, serving Navoi. A ‘Solar PV’ technology option is therefore the most suitable for the site.
- For the grid connection, a number of options were considered. The preferred option will entail direct connection to the 220 kV line adjacent to the PV site.

Therefore, although the site was not subjected to an assessment of alternatives process by Nur Navoi, it is considered that the site selection process carried out by IFC was robust and the site location meets the above criteria.

3. Legal and Policy Framework

3.1 Uzbekistan's Green Economy Strategy

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

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

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

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

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

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

3.2 Institutional framework

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

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

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

stable system of state service, development and realization of specialized programs, strategies and plans of actions and sustainable nature management. Regional departments and agencies are generally lower executive bodies of the SCNP and other responsible ministries on regional and district levels. Organizations at the regional level have the same structure as the republican level.

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

3.3 National Environmental and Social Legislation

3.3.1 Overview

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

- integration of economic and ecological policy for conservation and rehabilitation of the environment as a necessary condition for increasing the population's standard of living;
- Transition from protection of some individual environmental elements to a more general and complex protection of ecosystems;
- Placing a responsibility on all members of society for environmental protection, conservation of biodiversity and improvement of the conditions of the general population.

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

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

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

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

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

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

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

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

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

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

1. "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).
2. "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).
3. "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).
4. "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).
5. "On wastes" No. 362-II dt. April 5, 2002.
6. "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).
7. "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).
8. "On woods" No. 770-I dt. April 15, 1999 (last revision was made by Law of Uzbekistan No.238 dt. 22.12.2009).
9. "On protected nature territories" No. 710-II dt. December 3, 2004.
10. Law of Uzbekistan "On subsoils" is approved by Law of Uzbekistan No.444-II dt. 13.12.2002r. (last revision was made by Law of Uzbekistan No.133 dt. 18.12.2007.)
11. Law of Uzbekistan "On EIA" No. 73-II dt. May 25, 2000.

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

- Protection of the environment and its main components;
- Protection of ecosystems and regulation of usage of nature resources;
- Evaluation of influence on environment and ecological expertise;
- Regulation of compensations for damage made to environment (including economical and administrative aspects);
- Regulation of property rights for nature resources.

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

3.3.2 Requirements of the National EIA Procedure

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

1) Law of the Republic of Uzbekistan No 754-XII dated 09.12.1992 “On Environment Protection”;

2) Law of the Republic of Uzbekistan No 73-II dated 25.05.2000 “On Environmental Impact Audit”;

3) 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:

- 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

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

to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.

- Article 77 determines the age at which employment is permitted (i.e. 16 years old).
- Article 239 establishes that all persons under the age of 18 years shall be employed only after undergoing a preliminary medical examination and further until reaching the age of 18 are subject to mandatory annual medical examination.
- Article 7 prohibits forced labour, understood as work performed under threat of punishment (including as a means of labour discipline).
- Articles 211 and 212 establish requirements on labour protection, and the duties of the employee to comply with the norms, rules and regulations on labour and protection. The employee is obliged to comply with the norms, rules and regulations on labour protection, as well as the administration of the order of safe operation, use the obtained personal protective equipment, and immediately notify their supervisor (foreman, master, chief of a site, and others) if any accidents or situations that create a direct threat to human life and health occur.

Article 213 establishes the right of the worker to the information on occupational health and safety (OHS). At the conclusion of the employment contract and the transfer to another job worker shall be informed by the employer about working conditions, including the presence of risk occupational and other diseases due to him in connection with these benefits and compensation, as well as personal protective equipment. The employer must also inform employees or their representatives about the state of OHS in specific workplaces and production.

3.3.4 Archaeology and Cultural Heritage Legislative and Policy Context

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

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

3.3.4.1 Uzbek Legislative Context

The principal legislation applicable to the archaeology and cultural heritage study comprise the Constitution of the Republic of Uzbekistan[5], the Criminal Code of the Republic of Uzbekistan[6], 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.

[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

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 major damage shall be punishable by a fine, obligatory community service or by correctional labour up to three years. Article states that violation of a grave or a corpse, as well as the seizure of objects located on a corpse, grave or burial ground, shall be punishable by a fine, by corrective labour up to three years, by restriction of liberty or imprisonment from three to five years.
Code of the Republic of Uzbekistan on Administrative Responsibility	Article 64 notes that the violation of the rules for the protection and use of objects of tangible cultural heritage shall be sanctioned by a fine on citizens and officials. Construction or destruction of protected cultural property real estate objects in protected areas in specially protected historical and cultural territories without obtaining permission shall be sanctioned by a fine or administrative arrest.
Law No. 269-II "On the Protection and Use of Cultural Heritage Sites (30 August 2001, as amended)	Regulates the protection and use of cultural heritage objects (CHO), which are the national property of the people of Uzbekistan. The law protects ensembles, sites, monuments, objects of tangible and intangible cultural heritage. The law defines objects of tangible cultural heritage as representing historical, scientific, artistic or other cultural value ensembles, sites and monuments; and objects of intangible cultural heritage as representing customs, historical, scientific, artistic or other cultural value, folklore (the art of word, dance, music, performance), as well as knowledge, skills, tools, artefacts related to them and folk arts and crafts, and cultural spaces. Tangible cultural heritage is divided into CHO of national and local historical, scientific, architectural, artistic and memorial significance. Designated cultural heritage comprises World Heritage properties, elements inscribed on the Representative List of the Intangible Cultural Heritage of Humanity, CHO on the State Register, historical and cultural reserves, museum reserves and historical settlements. These are maintained on the State Cadastre of tangible CHO and the List of intangible objects of intangible CHO.
Law No. ZRU-229 "On protection and use of the objects of archaeological heritage" (13 October 2009)	Regulates the protection and use of the objects of archaeological heritage. The state has exclusive right of ownership of the objects of archaeological heritage. Objects of archaeological heritage are subject to compulsory state registration. The Ministry of Culture issues field investigation permits and approves the scientific report for each permit issued. Specially authorised institutions in the field of protection and use of archaeological heritage objects (authorised agencies) approve the procedures for archaeological exploration, archaeological excavations and archaeological surveillance, issue open sheets and participate in the historical and cultural examination of archaeological heritage sites.
Presidential Decree No. PP-4068 "Concerning measures on preservation of objects of cultural and archaeological heritage" (19 December 2018)	Includes a 'Road Map' to radically improve the protection, conservation, scientific research, propaganda and rational use of tangible cultural heritage objects for 2019-2021.
Presidential Decree No. R-5181 "On improving the protection and use of objects of tangible cultural and archaeological heritage" (16 January 2018)	Required the creation of a national digital inventory, used as the basis for developing comprehensive measures to radically improve the protection, conservation, scientific study, promotion and use of objects of tangible cultural and archaeological heritage in 2018-2023.

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

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

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

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

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

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

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3.3.4.2 Uzbek International Agreements and Conventions

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

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

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[12]	Prohibits and prevents the illicit import, export and transfer of ownership of cultural property and aims to discourage the pillage of archaeological sites and cultural heritage by controlling international trade in looted antiquities through import controls and other measures.	15 March 1996 (ratification)
UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) – 1972[13]	To ensure that effective and active measures are taken for the protection, conservation and presentation of the cultural and natural heritage on states' territories.	13 January 1993 (ratification)
UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage – 2003[14]	To safeguard and ensure respect for the world's Intangible Cultural Heritage, including raising awareness of the importance of intangible heritage and encouraging international cooperation and assistance.	29 January 2008 (ratification)
UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions – 2005[15]	Recognises the rights of states to protect and promote the diversity of cultural expressions, encompassing cultural and natural heritage, movable cultural property, intangible cultural heritage and contemporary creativity.	15 November 2019 (ratification)

3.4 International Agreements

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

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[16]

Name of Convention	Date of Ratification
C029 - Forced Labour Convention, 1930 (No. 29)	13 July 1992
C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)	12 Dec 2016
C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98)	13 July 1992
C100 - Equal Remuneration Convention, 1951 (No. 100)	13 July 1992
C105 - Abolition of Forced Labour Convention, 1957 (No. 105)	15 Dec 1997
C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	13 July 1992

[12] UNESCO 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property. Paris, 14 November 1970. United Nations Educational, Scientific and Cultural Organization http://www.unesco.org/new/en/culture/themes/illicit-traffic-of-cultural-property/1970-convention/
[13] UNESCO 1972 Convention concerning the Protection of the World Cultural and Natural Heritage. Paris, 16 November 1972. United Nations Educational, Scientific and Cultural Organization http://whc.unesco.org/en/conventiontext/
[14] UNESCO 2003 Convention for the Safeguarding of the Intangible Cultural Heritage. (Paris, 17 October 2003) United Nations Educational, Scientific and Cultural Organization http://www.unesco.org/culture/ich/index.php?pg=00006
[15] UNESCO 2005 Convention on the Protection and Promotion of the Diversity of Cultural Expressions. Paris, 20 October 2005. United Nations Educational, Scientific and Cultural Organization https://en.unesco.org/creativity/convention/2005-convention/2005-convention-text
[16] International Labour Organisation (ILO): Ratifications for Uzbekistan.
Website: http://ilo.org/dyn/normlex/en/f?p=1000:11200:0::NO:11200:P11200_COUNTRY_ID:103101 (date viewed: 28.02.2018)

Name of Convention	Date of Ratification
C138 - Minimum Age Convention, 1973 (No. 138)	06 Mar 2009
C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)	13 July 1992
C122 - Employment Policy Convention, 1964 (No. 122)	13 Jul 1992
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (IEA ID# 2793)	08/02/2002
Convention for The Protection of The World Cultural and Natural Heritage (IEA ID# 2812)	13/01/1993
Convention on International Trade in Endangered Species of Wild Fauna and Flora (IEA ID# 2814)	08/10/1997
Convention on The Conservation of Migratory Species of Wild Animals (IEA ID# 2896)	01/09/1998
Convention for The Protection of The Ozone Layer (IEA ID# 2982)	16/08/1993
Montreal Protocol on Substances That Deplete the Ozone Layer (IEA ID# 3021)	18/08/1993
Convention on The Control of Transboundary Movements of Hazardous Wastes and Their Disposal (IEA ID# 3042)	07/05/1996
Agreement on cooperation in the field of ecology and environmental protection (IEA ID# 2489)	08/02/1992
Agreement on Cooperation in The Field of Joint Water Resources Management and Conservation of Interstate Sources (IEA ID# 3113)	18/02/1992
Convention on The Protection and Use of Transboundary Watercourses and International Lakes (IEA ID# 3116)	03/12/2007
United Nations Framework Convention on Climate Change (IEA ID# 3126)	21/03/1994
Convention on Biological Diversity (IEA ID# 3128)	17/10/1995
Statute of the Interstate Commission for Water Coordination of Central Asia (IEA ID# 4765)	05/12/1992
Agreement on Joint Activities in Addressing the Aral Sea and The Zone Around the Sea Crisis, Improving the Environment, And Ensuring the Social and Economic Development of The Aral Sea Region (IEA ID# 3155)	26/03/1993
Convention to Combat Desertification in Those Countries Experiencing Serious Drought And/or Desertification, Particularly in Africa (IEA ID# 3188)	26/12/1996
Agreement on The Conservation of African-Eurasian Migratory Water birds (IEA ID# 3216)	01/04/2004
Agreement between the Government of Kazakhstan, the Government of Kyrgyzstan and the Government of Uzbekistan on management of water resources in Central Asia (IEA ID# 8452)	05/04/1996
Agreement on The Use of Water and Energy Resources of The Syr Darya Basin (IEA ID# 3279)	07/05/1999
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (IEA ID# 2793)	08/02/2002
Convention for The Protection of The World Cultural and Natural Heritage (IEA ID# 2812)	13/01/1993
Convention on International Trade in Endangered Species of Wild Fauna and Flora (IEA ID# 2814)	08/10/1997
Convention on The Conservation of Migratory Species of Wild Animals (IEA ID# 2896)	01/09/1998
Convention for The Protection of The Ozone Layer (IEA ID# 2982)	16/08/1993
Montreal Protocol on Substances that Deplete the Ozone Layer (IEA ID# 3021)	18/08/1993
Convention on The Control of Transboundary Movements of Hazardous Wastes and Their Disposal (IEA ID# 3042)	07/05/1996

Name of Convention	Date of Ratification
Agreement on cooperation in the field of ecology and environmental protection (IEA ID# 2489)	08/02/1992
Agreement on Cooperation in The Field of Joint Water Resources Management and Conservation of Interstate Sources (IEA ID# 3113)	18/02/1992
Convention on The Protection and Use of Transboundary Watercourses and International Lakes (IEA ID# 3116)	03/12/2007
United Nations Framework Convention on Climate Change (IEA ID# 3126)	21/03/1994
Convention on Biological Diversity (IEA ID# 3128)	17/10/1995
Statute of the Interstate Commission for Water Coordination of Central Asia (IEA ID# 4765)	05/12/1992
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Agreement on The Use of Water and Energy Resources of The Syr Darya Basin (IEA ID# 3279)	07/05/1999

3.5 International Best Practice Guidelines

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

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

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

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

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

3.5.1 Equator Principles and IFC Performance Standards

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

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

The IFC PS are detailed below:

- IFC PS1 – Assessment and Management of Environmental and Social Risks and Impacts.
- IFC PS2 – Labour and working conditions.
- IFC PS3 – Resource Efficiency and Pollution Prevention.
- IFC PS4 – Community Health, Safety, and Security.
- IFC PS5 – Land acquisition and involuntary resettlement.
- IFC PS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- IFC PS7 – Indigenous peoples.
- IFC PS8 – Cultural heritage.

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

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

3.5.2 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.

4. Environmental and Social Assessment Methodology

An initial assessment of impacts was carried as part of the Preliminary ESIA. A number of criteria were used to determine whether or not a potential impact of the Project could be considered 'significant'. These are outlined with reference to specific environmental and social issues in the subsequent topic chapters of this Preliminary ESIA Report. Wherever possible, a quantitative assessment of the impacts was undertaken. Where this was not possible, a qualitative assessment of impacts was carried out, based on existing information available for the site and the surrounding study area, and experience with other solar PV developments.

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

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

4.1 Baseline

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

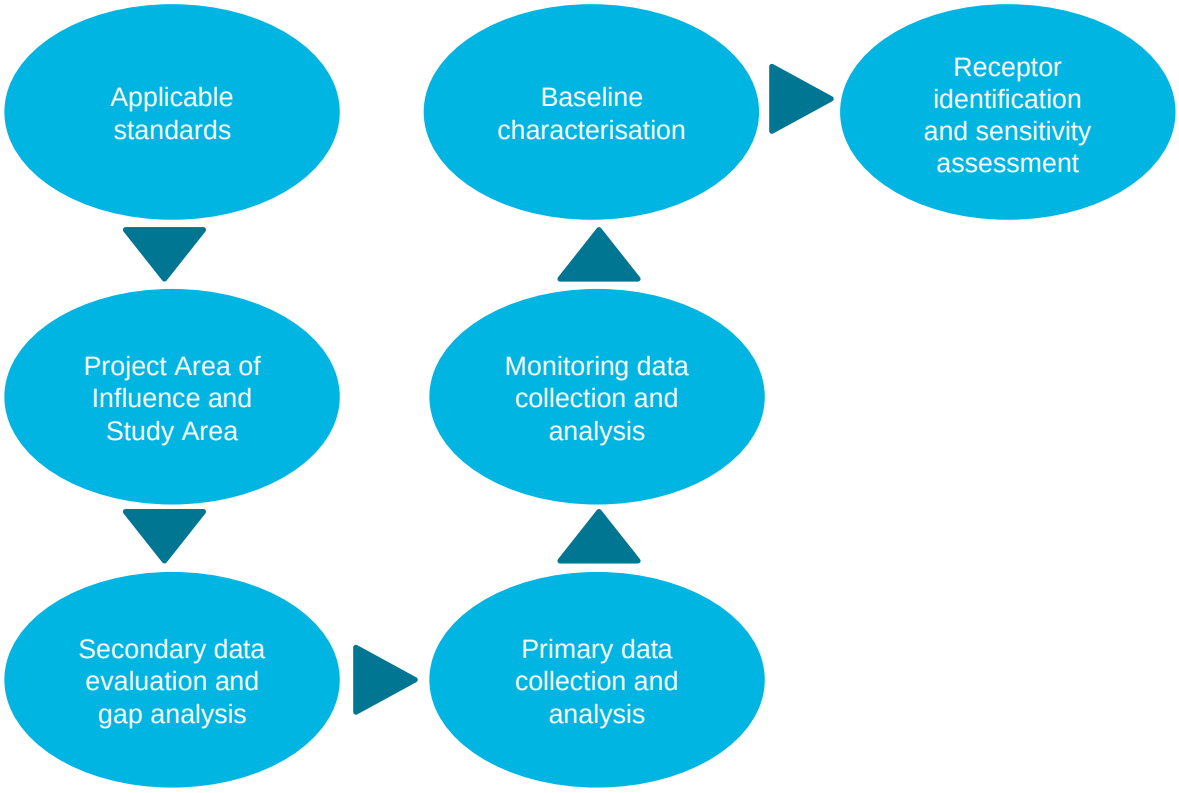

Figure 4-1. Approach to Baseline Characterisation

4.1.1 Project Area of Influence and Study Area

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

The AoI (based on the definition in IFC PS1) adopted by the Project is:

- The area likely to be affected by:

  - Project activities and facilities that are directly owned, operated, or managed (including by contractors) by the Project Proponent and that are a component of the Project;
  - Impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location; or
  - Indirect Project impacts on biodiversity or on ecosystem services upon which 'Affected Communities'[17] livelihoods are dependent.
- Associated facilities, which are facilities that are not funded as part of the Project and that would not have been expanded if the Project did not exist and without which the Project would not be viable. It is anticipated there will not be any associated facilities for the Project; and
- Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the Project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted.

Using this definition of the Project components an Area of Influence was prepared 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. This has been deemed to represent the area bounded by the two collectors to the west and east, the Highway to the south and the Zarafshan River to the north.
- Area within the zone of theoretical visibility of the solar panels.
- Area of 100 m either side of roads and access tracks.
- Area of 100 m either side of overhead lines.

A series of AOI maps were prepared and have been used to identify survey areas, stakeholders and project affected peoples (PAPs) who would be 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.

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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.

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 March 2020 at selected locations within the AoI. Field surveys were undertaken for the following ESIA topics: soil and ground conditions, surface water, terrestrial ecology, cultural heritage, traffic, landscape and visual, and social (including meetings with stakeholders).

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

Primary and secondary baseline data were evaluated by the technical subject matter experts.

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

4.2 Impact Assessment

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

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

The sensitivity of the receptor depends upon the relative importance of existing environmental features on or in the vicinity of the site or the sensitivity of receptors which have the potential to be affected by 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 used will very much 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. The methodology for determining magnitude and sensitivity will be clearly defined in the respective technical chapter.

Table 4-3 Assessment Criteria – Significance of Impact

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

Magnitude of Change / Impact	High	Medium	Low	Negligible
Medium	Major	Moderate	Low	Low
Low	Moderate	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[18].

The rapid cumulative impact assessment involves a combination of desk-based research and engagement with stakeholders. The identification and management of cumulative impacts are limited to those effects generally recognized as important on the basis of scientific concerns and/ or concerns of affected communities.

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.

AECOM ensured the ESIA process effectively interacts with other pre-application project activities, to generate an improved development proposal, and better environmental outcomes that otherwise would not have been achieved.[19] 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 to deliver a better environmental outcome without impacting the viability of the project then these have been identified.

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

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

[18] IFC and ESSA Technologies Ltd (2013). Good Practice Handbook: Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets.

[19] Institute of Environmental Management and Assessment (2015). Environmental Impact Assessment Guide to Shaping Quality Development November 2015. http://www.lda-design.co.uk/wp-content/uploads/2015/11/IEMA-Guide-to-Shaping-Quality-Development.pdf

- 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.

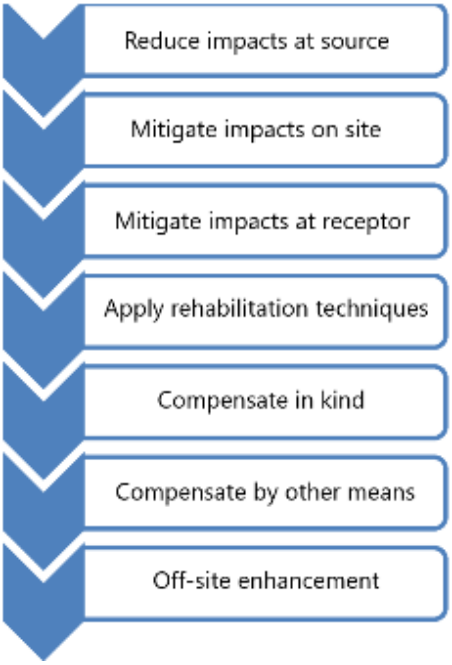

Figure 4-2: Mitigation Hierarchy

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.

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

4.2.3 Assessment of Residual Impacts

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

5. Stakeholder Engagement Programme

As part of the ESIA study, AECOM has carried out a stakeholder engagement programme which is documented in more detail in the Stakeholder Engagement Plan.

The programme of engagement activities presented in Table 5-1 was focused on engagement activities Nur Navoi are completing during the EIA and ESIA phases of the planned Project. During these activities, stakeholders expressed concerns and asked questions about what happens during and after the construction and operations activities. The programme will be updated following each formal engagement activity undertaken. The aim of these activities was 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 to Nur Navoi; and
- Manage grievances through the Grievance Mechanism.

Brief information on the different communication methods for carrying out stakeholder engagement is presented in Section **Error! Reference source not found.**.

This SEP (and the engagement programme) will be updated with the Project moving to the construction stage, as well as upon commencing the operations.

5.1 Previous Stakeholder Engagement Activities: Scoping and ESIA Phases

The first official round of stakeholder engagement activities (from an E&S perspective) took place in Navoi (city) and in Uzumzor on the 5th and 6th of March 2019.

Further stakeholder engagement took place in March 2020 as part of the Preliminary ESIA phase.

The stakeholders identified and relevant information about the outcomes of the meetings are described below.

Table 5-1: Summary of Stakeholder Engagement to Date

Date	Stakeholders	Stakeholder Engagement Methods	Location	Purpose	Summary Feedback
6 March 2019	• Farm A Landowner	Face-to-face meetings	At Farm A	• Inform the relevant stakeholders about the proposed project; • Capture views and concerns of the relevant stakeholders about the project; • Understand the needs of the communities and capture valuable information to make an informed decision.	Did not attend meeting
6 March 2019	• Farm B land user	Face-to-face meetings	At Farm B	• Inform the relevant stakeholders about the proposed project; • Capture views and concerns of the relevant stakeholders about the project; • Understand the needs of the communities and capture valuable information to make an informed decision.	Farm B are content with the development, but they are concerned about the lack of response to obtain alternative land from the Administration.
6-7 March 2019	• Deputy Khokim of Navoi region • Chief of the Main Department • Chief specialist of the Investments department of Navoi region • Deputy Khokim of Karmana district on investment, innovation, support of privatized enterprises, free economic and small industrial zones as well the development of tourism • Head of District Irrigation Department • Chief Engineer, Cadastral officials of Karmana district	Common meeting at the Provincial Administration Offices	Navoi City	• Identify and prioritize key stakeholder groups; • Inform the relevant stakeholders about the proposed project; • Capture views and concerns of the relevant stakeholders about the project; • Understand the needs of the communities and capture valuable information to make an informed decision; • Enhance ownership of the Project within the host communities; • Provide a basis for stakeholder participation in impact identification and mitigation; • Provide a basis for managing and responding grievances from the local communities and other stakeholders, and	Generally satisfied with the project. Observations made in terms of: • Nature of the canal adjacent to the site (irrigation) and permits to obtain water. • General status of the proposed land, previous and current contracts (right of use).

Date	Stakeholders	Stakeholder Engagement Methods	Location	Purpose	Summary Feedback
				• Provide a strategy and timetable for sharing information and consulting with each of these groups.	
6-7 March 2019	• Chairman of the mahalla committee Malik (Uzumzor is part of the Mahalla Malik)	Meeting at the Local Administration Offices	Uzumzor	• Understand the EIA regulatory framework; • Explain the Project and its expected effects; • Get the views and opinions on potential Project impacts; • Gather existing baseline information on the environmental aspects.	Satisfied with the fact the that project will be developed in the local council she rules. She mentioned that there is a community (named Residential Area in the Project Location section), that apparently is not within her jurisdiction, with a high unemployment rate.
6-7 March 2019	• Specialist from the Women's Committee	Meeting at the Provincial Administration Offices	Uzumzor	• Capture views and concerns of the relevant stakeholders about the project.	They have a programme to integrate women, including but not limited to vulnerable categories (e.g. ex-convicts, domestic violence, etc.), in the job market. They offered support to the future concessionaire to help recruit women for the project.
12 April 2019	• Cadastral officials of Karmana district	Navoi Khokimiyat	Navoi	• Confirm that there were no grievances, open claims or court cases, filed by the project area land occupiers/users with the government.	No issues identified
PRELIMINARY ESIA PHASE					
2 March 2020	• Kamoliddin Khasanov. Deputy Khokim of Navoi Region on Investments	Face-to-face meetings	Navoi Khokimiyat	• Mission tasks, stakeholders meeting list •	• Overview of the region economic indicators
2 March 2020	• Elbek Gafforov. Deputy Head of Investment Department n of Navoi Region Khokimiyat	Face-to-face meetings	Navoi Khokimiyat	• Mission tasks, stakeholders meeting list	• Provided general support to the ESIA team.
2 March 2020	• Hurshid Karamatov. Investment and Foreign Trade Department of Navoi Region Khokimiyat	Face-to-face meetings	Navoi Khokimiyat	• Mission tasks, stakeholders meeting list	• Provided general support to the ESIA team.
2 March 2020	• Mumin Ikromov. Head of Navoi region Melioration Department	Face-to-face meetings	Navoi Khokimiyat	• Specialists required for the meeting	• Provided general support to the ESIA team.
3 March 2020	• Abbos Ibragimov. Lead Specialist of Navoi Region Irrigation Department	Face-to-face meetings	Navoi Khokimiyat	• Specialists required for the meeting	• Information provided on irrigation canals, water abstraction permits and issues.

Date	Stakeholders	Stakeholder Engagement Methods	Location	Purpose	Summary Feedback
3-7 March 2020	• Sherzod Jumaev. Deputy Khokim of Karmana District	Face-to-face meetings	Navoi and Karmana Khokimiyat	• Arranging the meetings and support with any information required.	• Provided general support to the ESIA team.
4 March 2020	• Farm B land user	Face-to-face meetings	At Farm B	• Inform the relevant stakeholders about the proposed project status; • Capture views and concerns about the project.	• As per previous meeting Farm B are content with the development, but they are concerned about the lack of response to obtain alternative land from the Administration.
4 March 2020	• Participants: consultants (Yusupova Saida, Sharipova Elmira), representative of the Karmana khokimiat, teachers of school No. 26, representatives of the makhalla committee, elders and residents of the makhalla Malik (Kurgan Gulshan) and a doctor from the rural medical center of the mahalla Malik.	Meeting at the local school 26	Malik	**The purpose of the meeting** is to present the project; answer to questions of the residents in connection with a new project in the mahalla. The following issues were discussed: • Construction of a solar power plant (SPP). • SPP is planned to be built on the territory of Uzumzor village, a part of the makhalla Malik. • Brief information about the company • Company projects in other countries • Area of the SPP • Technology to be deployed at the plant (solar panels) • Impact on the residents •	Questions and answers session: - What will be the environmental impact of the project? - How many jobs will be created? - What kind of specialists will be needed? - What technology will be used when installing solar panels? - Have such projects been implemented in Uzbekistan? - Are there any similar projects in neighboring countries? - Who is the customer of the project? - Will there be a change in electricity tariffs for the population? - Where will the equipment come from? - How many kilometers from the SPP to the village? - Who is the developer of the SPP project? - Will provide services to repair solar panels installed by the population (for private use)? - Drinking water coming through Damhodzha waterpipe in the summer has a weak watercourse. Gulshan barrow is located above the level of the water conduit and resedents pump water. Such situation exists only in this section of the Mahalla. Other sections are below the water level. Residents are afraid that if the SPP uses water, they will receive less water for their own needs. - Farmers use water for irrigation from the Ami-Bukhoro canal and from two collectors. This summer, water was significantly reduced. Will there be enough water for irrigation and for the needs of the SES?

Date	Stakeholders	Stakeholder Engagement Methods	Location	Purpose	Summary Feedback
					- Why this construction is prioritised? Law on Renewable Energy Lawa and the need for additional electricity capacity. - When will construction begin and when will the SPP start operations?
4 March 2020	• Present: Yusupova Saida, Sharipova Elmira, representative of the Karmana khokimiat, teachers of school No. 23, representatives of the makhalla committee, residents of the mahalla Malik, Uzumzor village	Meeting at the local school 23	Uzumzor	• The purpose of the meeting is to present the project; answer to questions of the residents in connection with a new project in the mahalla.	Questions & answers and suggestions received: - For what needs the electricity generated by SPP to be used? - Who is the developer of the project? - What will be the impact on the environment? - During the work of the SPP, will there any radiation and what impact can it have on children? - Will jobs be created? - How can we get information about possible vacancies and employment opportunities for local residents in the SPP project? - Residents would like to receive information about vacancies at the SPP through the mahalla committee and the employment center. - Is it possible to organize additional training for local specialists for employment in the SPP project? - Will there be an increase in taxes and payments in connection with the construction of the SES? - Where will the SES be located? - Will there be an impact on plants and wildlife? - Project cost? - The approximate cost of the project is $ 100 million per 100 MW. - Is it possible to get sponsorship from project owners for educational purposes, educational programs, trainings for school students on the topic of solar

Date	Stakeholders	Stakeholder Engagement Methods	Location	Purpose	Summary Feedback
					energy, and assistance in obtaining better Internet for educational purposes? - To work at the SES, what education do you need to receive and in which educational institution?
4 March 2020	• Xamraeva Inobat. Chair of Malik Mahalla, Kaldirgoch village	Face to face meeting	Malik Mahalla, Kaldirgoch village	• Informing about the project • Interviewing and collecting social baseline data	• Provided general socio-economic discussion of issues affecting the project area and locality.
4 March 2020	• Nilufar Gafforova. Chief specialist on women and gender issues, Malik Mahalla	Face to face meeting	Malik Mahalla, Kaldirgoch village	• Informing about the project • Interviewing and collecting social baseline data on gender and women issues	• Provided social baseline data on gender and women issues
5 March 2020	• Gulnoza Shermatova. First Deputy, Department for support of marhalla and families, Karmana Khokimiyat	Face to face meeting	Karmana Khikimiyat	• Informing about the project • Interviewing and collecting social baseline data on gender and women issues	• Provided social baseline data on gender and women issues
5 March 2020	• Khusnitdin Shovkiev. Research specialist on tourism and archaeology, Karmana museum	Meeting on site.	On site	• Join visit to the project site and collecting data on archaeological sites	• Provided specialist support on site.
5 March 2020	• Nuriddin Hamraev. Specialist of Karmana District Kadastr Department	Face to face meeting	Karmana Khokimiyat	• Information on the land lease process.	• Legal status of the land of the project • Land allocation procedures for farmers A and B;
5 March 2020	• Muzafar Sharipov. Head of investment department of Karmana Khokimiyat	Face to face meeting	Karmana Khokimiyat	• Discuss the Project details, make preliminary agreements and arrangements that need to be in place as part of the Project design documentation development process/getting various approvals	• Additional information on landowners and land allocation procedures
5-6 March 2020	• Akbar Asloitov. • Lead Specialist on biodiversity of Navoi Region Environment Committee	Meeting on site.	On site	• Data collection on flora and fauna of the project area	• Provided specialist support on site.
6 March 2020	• Specialists of the Emirate Centre for the Conservation of the Houbara in Navoi	Face to face meeting	Emirate Centre for the Conservation of the Houbara	• Observation of avifauna data	• Provided overview of Houbara bustard conservation work, range and confirmed site is unlikely to support any breeding pairs.
6 March 2020	• Otabek Zaripov. Head of water department of Karmana District	Face to face meeting	Karmana Water Department	• Information about water pipe on the project area;	Documents and maps of the pipe provided.

Date	Stakeholders	Stakeholder Engagement Methods	Location	Purpose	Summary Feedback
6 March 2020	• Rustan Matsuev. Chief Engineer, water department of Karmana District	Face to face meeting	Karmana Water Department	• Information about water pipe on the project area;	Documents and maps of the pipe provided.

Figure 5-1: Meeting at School 26

Figure 5-2: Meeting at School 26 (2)

Figure 5-3: Meeting at School 23

5.2 Future Stakeholder Engagement Activities

Nur Navoi will implement and maintain the Stakeholder Engagement Plan to engage and build a robust relationship with all Project stakeholders (the ones outlined above as a minimum, including the users of the Farm A and the Farm B even if the alternative land provided by the Administration is elsewhere). The SEP shall involve a range of activities such as public disclosure of appropriate information, consultation with stakeholders, and mechanisms by which people can make comments and raise grievances. The SEP shall be aligned to the guidance provided below.

It should be noted that the stakeholder engagement is understood as continuous process and it will be maintained by Nur Navoi (owner) through the entire life cycle of the project or until Nur Navoi transfers the ownership of the project to a different party once the PPA expires. Stakeholder engagement responsibilities will not be transferred to contractors (EPC or O&M).

This section describes the proposed tools that can be used to fulfil the objectives of the SEP. Additional tools might be used following additional consultation with the stakeholders.

The engagement tools that can be used are divided into the following categories:

- Notification methods: Used to inform the identified 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, and
- External grievance mechanism: System to receive and facilitate resolution of the stakeholder's concerns and grievances about project-related issues.

The following section describes the proposed timeline for the stakeholder engagement during the ESIA phase and the tools that are proposed for each stakeholder engagement phase and for each type of stakeholder.

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

Table 5-2: Stakeholder Engagement Programme

Stakeholder Category	Stakeholder Engagement Methods	Location/ Timeline	Purpose	Consultation Disclosure Materials	Mean of Advance Notification
ESIA DEVELOPMENT PHASE					
• Deputy Khokim of Navoi region • Chief of the Main Department • Chief specialist of the Investments department of Navoi region • Deputy Khokim of Karmana district on investment, innovation, support of privatized enterprises, free economic and small industrial zones as well the development of tourism • Head of District Irrigation Department • Chief Engineer, Cadastral officials of Karmana district	One-to-one meetings	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Get the views and opinions on potential Project impacts; • Gather existing baseline information on the environmental aspects.	Project leaflet / ESSR	Phone/email
Chairman of the mahalla committee Malik (Uzumzor is part of the Mahalla Malik)	One-to-one meeting	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Get the views and opinions on potential Project impacts; • Gather existing baseline information, e.g. on livelihoods, demographics, health status, infrastructure, best approaches to further stakeholder engagement, key issues of concerns in the area	Project leaflet / ESSR	Phone/email
Specialist from the Women's Committee	One-to-one meeting	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Get the views and opinions on potential Project impacts; • Gather existing baseline information, e.g. on land use issues: how the project site and the surrounding lands are currently used	Project leaflet / ESSR	Phone/email
Cadastral officials of Karmana district	One-to-one meeting	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Get the views and opinions on potential Project impacts; • Gather existing baseline information, e.g. on water supply issues: water use patters, municipal infrastructure – availability and capacities	Project leaflet / ESSR	Phone/email
Land users	• One-on-one meetings	Location/Date: [TBC and will be decided on	• Provide update on Project status; • Collect information on the villages' profiles – demography livelihoods, farming, livestock,	Project presentation Grievance Mechanism leaflet	Via the aksakals/phone

Stakeholder Category	Stakeholder Engagement Methods	Location/ Timeline	Purpose	Consultation Disclosure Materials	Mean of Advance Notification
		relaxation of Covid-19 restrictions]	health problems, gender roles, land use (herding, tracks), public infrastructure use, key problems in the area and potential concerns • Explain the Project and its expected effects; • Get the views and opinions on potentially concerning issues; • Share information on the Grievance mechanism.		
Wider local community of Uzumzor	• Leaflets in public places • Media announcements • Grievance mechanism	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Get the views and opinions on potentially concerning issues; • Share information on the Grievance mechanism.	Project leaflet (incl. information on the Grievance Mechanism)	Leaflets in public places Media announcements
Other governmental departments/agencies	• One-to-one meetings • Data collection requests • Email correspondence • Phone calls [Depending on the Project needs and within each body's remit and field of responsibility]	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Get the views and opinions on potential Project impacts; • Obtain the necessary approvals.	Project leaflets/ESHIA scoping report/Official correspondence	Phone/email/personal interaction
Non-Government Organisations	• One-to-one meetings • Email correspondence • Phone calls	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Discuss opportunities for cooperation	Project leaflet / ESSR	Phone/email/personal interaction
Media	• Media announcements • Grievance mechanism	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Share information on the Grievance mechanism.	Project leaflet / ESSR	Phone/email
Research/Educational Organisations	• One-to-one meetings • Data collection requests • Email correspondence • Phone calls [Depending on the Project needs and within each body's remit and field of responsibility]	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Provide update on Project status; • Get the views and opinions on potential Project impacts; • Gather existing baseline information; • Share expectations on the employment	Project leaflet / ESSR	Phone/email
EIA /ESIA DISCLOSURE PHASE					

Stakeholder Category	Stakeholder Engagement Methods	Location/ Timeline	Purpose	Consultation Disclosure Materials	Mean of Advance Notification
All stakeholder groups	• Disclosure online • Placement of paper versions in public places • Leaflets in public places • Media announcements	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Disclose and discuss the results of the ESHIA study online	NTS of the ESIA online	Media announcements Website announcements
Regional Government Agencies	• One-to-one meeting	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Discuss/coordinate the public hearing event on the local EIA results	Local EIA package	Personal interaction
Local libraries	• One-to-one meetings • Phone calls • Placement of paper versions • Placement of leaflets	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Arrange disclosure of the local EIA package	Local EIA package	Personal interaction
All stakeholder groups	• Public hearing event • Placement of leaflets in public places • Media announcements	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Comply with the RUz EIA regulatory requirements • Disclose and discuss the results of the EIA study	Local EIA package NTS of the ESIA online	Media announcements
CONSTRUCTION PHASE					
All stakeholder groups	• Disclosure online • Placement of paper versions in public places • Leaflets in public places • Media announcements	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Disclose and discuss the construction status and any major events due to take place (component delivery for example).	Notices	Media announcements Website announcements. Notice posted in public locations.
Regional Government Agencies	• One-to-one meeting	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Disclose and discuss the construction status and any major events due to take place (component delivery for example).	Local EIA package	Personal interaction
Local libraries	• One-to-one meetings • Phone calls • Placement of paper versions • Placement of leaflets	Location/Date: [TBC and will be decided on relaxation of Covid-19 restrictions]	• Disclose and discuss the construction status and any major events due to take place (component delivery for example).	Local EIA package	Personal interaction Notice posted in public locations
All stakeholder groups	• Public event • Placement of leaflets in public places	Location/Date: [TBC and will be decided on	• Disclose and discuss the construction status and any major events due to take place (component delivery for example).	Local EIA package NTS of the ESIA online	Media announcements Notice posted in public locations

Stakeholder Category	Stakeholder Engagement Methods	Location/ Timeline	Purpose	Consultation Disclosure Materials	Mean of Advance Notification
	• Media announcements	relaxation of Covid-19 restrictions]			

6. Environmental and Social Baseline

6.1 Overview

Specific local conditions have been described from a combination of desk-based review and site survey. The preliminary site reconnaissance was carried out by the Typsa E&S Scoping team on the 30 October 2018 followed up by detailed ground investigations in January 2019. A further E&S visit took place in March 2019.

Further primary baseline data was collected by the AECOM ESIA team during March 2020 as part of the Preliminary ESIA studies and these were used to fill any knowledge gaps for the baseline section of the ESIA report. A final site visit is proposed for the detailed ESIA study.

6.2 Field Reconnaissance

The initial reconnaissance exercise was undertaken in October 2018 and involved a walkover of the Project site, as well as the area immediately surrounding the Site. Further site walkovers and intrusive investigations were carried out during January 2019, March 2019 and March 2020 visits to the Project area.

Table 6-1: Record of Field Reconnaissance

Date	Description and purpose
30 October 2018	The first reconnaissance was undertaken on October 30th, 2018 by a team of three consultants, two consultants from Typsa and one consultant from the local E&S subcontractor.
9-26 January 2019	Ground investigations were carried out from January 9 to 26 by ELLIPS, and a geotechnical expert from TYPSA was on site supervising the ground investigations, including the procedures and the collection of samples. A chemical analysis of the water quality of adjacent drainage canals was performed.
5-6 March 2019	The other two trips were done on March 5th and 6th 2019 by one consultant from Typsa, one consultant from 5 Capitals and one consultant from the local E&S subcontractor. The information provided in the baseline section is based on satellite imagery, information provided by an Uzbekistani environmental consultancy, information captured during a site visit undertaken by the 5 Capitals' team on the 5th and 6th of March 2019, and information provided by administrative, interest and affected based stakeholders during consultation meetings. The first official round of stakeholder engagement activities (from an E&S perspective) took place in Navoi (city) and in Uzumzor on the 5th and 6th of March 2019.
3-6 March 2020	Ecology, social, archaeological site surveys carried out by AECOM with one specialist from Green Business Innovation and an ecologist from Navoi. Social surveys took place at Uzumzor and stakeholder meetings were held in Navoi and Uzumzor.

6.3 Physical characteristics

6.3.1 Climate and Meteorology

The average annual precipitation for 2010-2017, according to weather stations[20] varies from 74.0 mm to 284.2 mm per year. The annual amount of precipitation for several years (2010-2017) within the irrigated area varies from 97.0 mm to 284.2 mm. Most of the precipitation (70-90%) occurs in the winter and spring. In summer rainfall is rarely observed. Average annual air temperature in the area of Navoi city equals to 15.87 ℃. The coldest month is January (average temperature is 2.77℃), the hottest one is July (average temperature is 28.78 ℃). Absolute minimal air temperatures in a cold period of a year reach – 17.4℃. Absolute maximum value is observed during the period of time from May to August and is more than 40℃ (43.8 ℃ in 2007).

The monthly weather averages are shown in more detail in the figures below.

[20] Data from nearest weather station: Samarkand, Uzbekistan (146.0 KM).

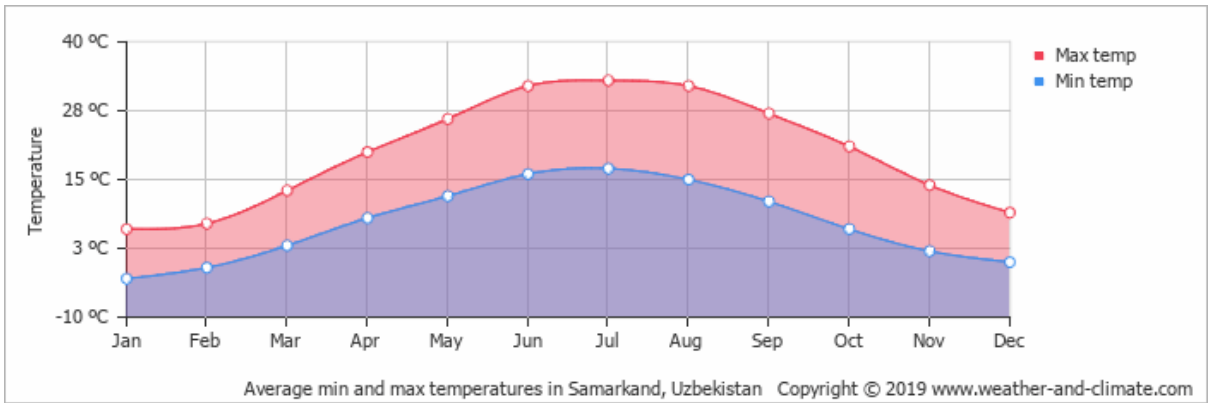

Figure 6-1: Average minimum and maximum temperature over the year

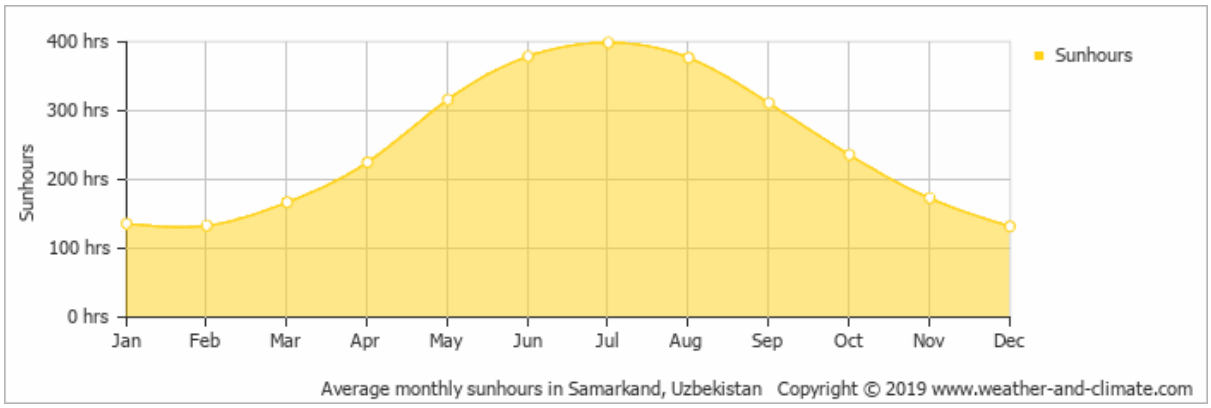

Figure 6-2: Average monthly hours of sunshine over the year

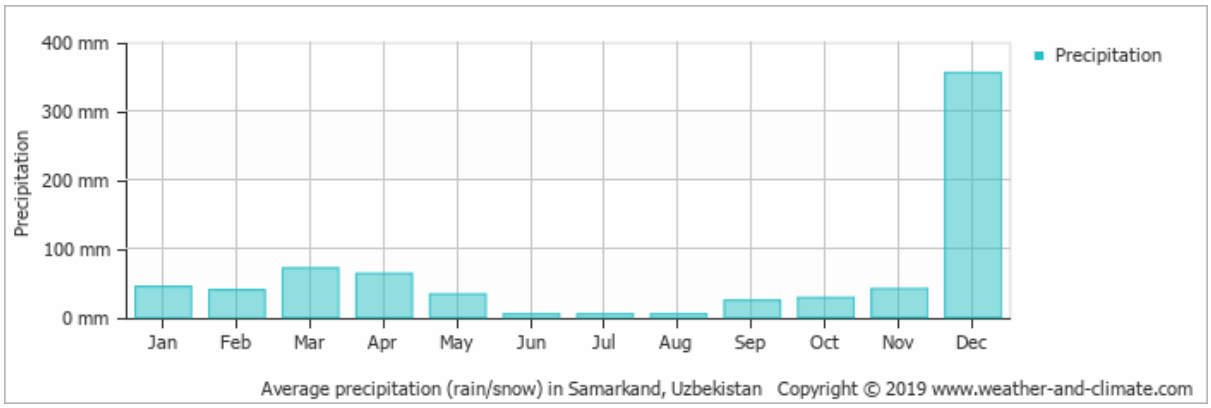

Figure 6-3: Average monthly precipitation over the year (rainfall, snow)

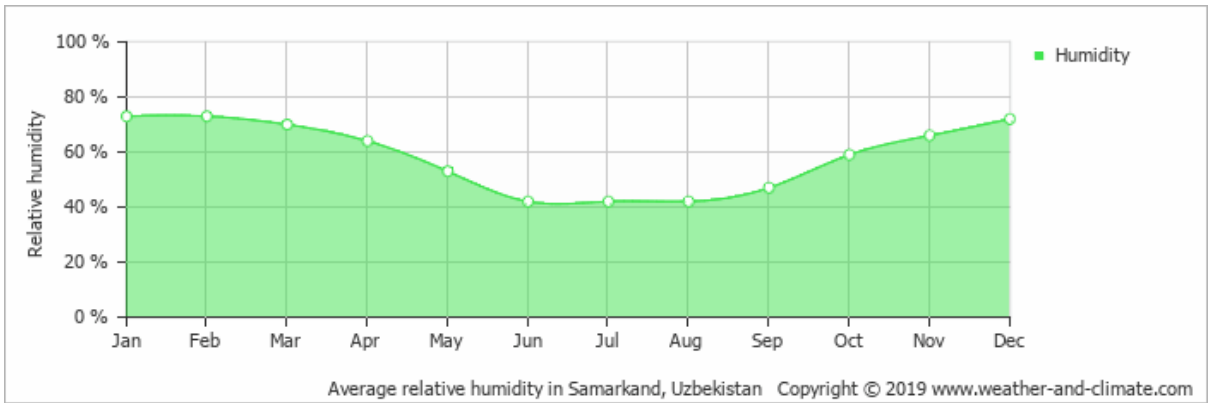

Figure 6-4: Average humidity over the year

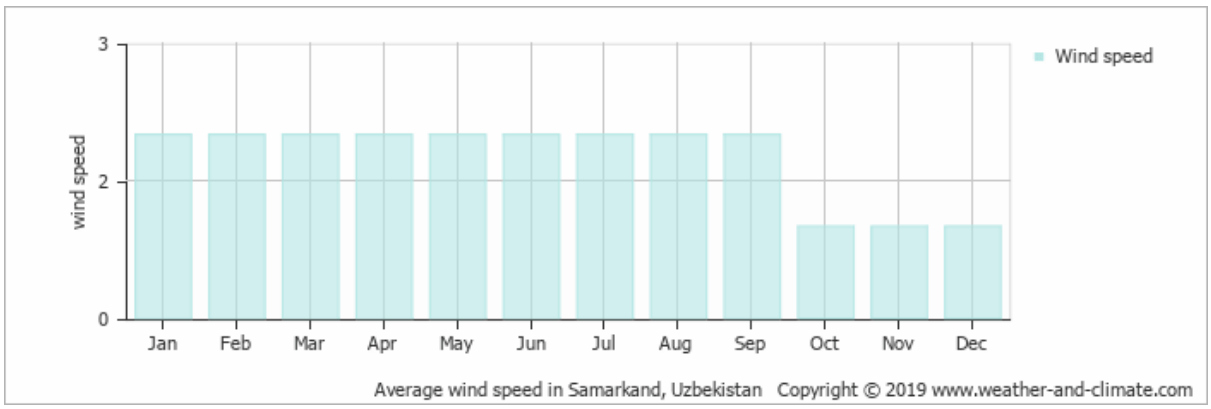

Figure 6-5: Average wind speed over the year

6.3.2 Geology and Soils

6.3.2.1 Overview

A study of the geology encountered in the region has been carried out based on desktop research and the site survey carried out during the initial geotechnical survey on site. This study was carried out and reported by TPYSA and has been summarised within this chapter.[21]

6.3.2.2 Ground investigations

Ground investigations were carried out from January 9 to 26, 2019 by ELLIPS, and a geotechnical specialist from TYPSA was on site supervising the ground investigations, including the procedures and the collection of samples. Site investigations included the following:

- Surface geological survey (1)
- Trial pits (23)
- Dynamic penetration tests (22)
- Boreholes (1)
- Vertical electric soundings (1)

22 trial pits were excavated by means of a drilling machine with a 45cm diameter helical auger. Pits were excavated to a depth of 3 meters, except when problems arose during excavation, due to excessive hardness of soil which occurred on three occasions, P-4, P-15 and P-21, where the final depth was limited to 2.5, 2.7 and 2.5 meters respectively.

In addition, one trial pit was manually excavated to a depth of 1.6 meters, with the aim of obtaining undisturbed soil samples.

[21] TYPSA, 2019. Geotechnical Report. Project SP5331. Code SP5331-Geotechnical-00-D02.docx

Dynamic penetration tests were carried out until rejection occurred, which was encountered at depths of between 1.9 and 3.7 meters, although in the majority of cases it took place between a depth of 2 and 3 meters.

The borehole was of a continuous core recovery type and extended to a depth of 8.8 meters. Due to drilling difficulties, two boreholes were started. The first of stopped at a depth of 3.3 meters, and the second one, located at a distance of 3 meters from the first, extended to a depth of 8.8 meters from the surface. 7 SPT tests were carried out in the borehole.

Disturbed samples were obtained from the extracted soil in borehole and trial pits. 40 samples were numbered in pits and three in the borehole. Furthermore, one undisturbed sample was obtained in the manual pit MP-1. Additionally, two water samples were collected from the adjacent channels, east and west of the plot, for chemical analysis.

Vertical electric soundings had a maximum AB/2 extension of 65 meters, and it is understood that a depth of between 20-25 meters has been explored.

All these research points were scattered around the plot following a regular pattern, aimed at covering the whole project area involved. The borehole and two additional pits/dynamic penetration tests couples were located on the east end, where placement of the control building and main electric facilities was considered to be most likely.

Based on the results of the on-site research, a laboratory test program was carried out. Some identification, strength, compaction and chemical tests were carried out on the samples extracted on site.

6.3.2.3 Local Geology

From a geological point of view the solar plant area is located on an extensive and plain surface, as a part of the fluvial terrace of the Zarafshan river, about 20 to 25 meters above the flood plain of the river.

The Quaternary sedimentary bodies were deposited predominantly by river systems and intermittent streams during uplift of the Tien Shan ridges at the central and eastern area of Uzbekistan. Four sedimentary sequences record four episodes of mountain uplift. Each sequence started with conglomeratic layers and ended with sandstone and shale. These deposits left river terraces on four levels which are well preserved in mountainous regions.

In this area, the terrace is mainly made up of sandy gravel to the surveyed depth (8.8 meters on the PV plant site), though a superficial sandy silt layer has been detected on the surface.

This gravelly body mainly occupies a huge area south of the Zarafshan river and has been identified and described on the cuts over the alluvial plain of the river (C-4 soil cut – see Annex 3 of Typsa report), in the actual PV plant plot (at a distance of about 4.5 km from the river) and to the south, beyond the area being studied.

The gravel is made up of rounded quartzite pebbles less than 10cm in diameter, immersed in a silty sandy matrix and interbedded with sand layers. Gravel is prevailing in observed points, though sandy layers may be present in some places.

This gravel body is deeply embedded in gypsum near the surface, though salinization seems to lessen as the depth increases. Most of surveyed points are no more than 2 or 3 meters deep and they all are deeply primed by gypsum (see C-4 and C-5 cuts in Annex 3 of Typsa report), though in pits and borehole carried out on site (where gravel is below the superficial sandy silt layer) the presence of gypsum is relatively low, and seems to decrease as the depth increases.

This gravelly body is part of the old deposits of the Zarafshan river, that are now above the river elevation due to the subsequent fluvial erosion.

Over this sandy gravelly body, a superficial sandy silt body exists. It is mostly made up of sandy silts that occasionally become silty sand, occasionally with a proportion of gravel. Its thickness is very low, about 2 meters, and it covers the entire PV plot.

Although the occasional presence of pebbles could advise us as to the fluvial origin of the soil, the extreme abundance of the particle size 0.1 - 0.05mm (fine sand - silt, see chapter 5) suggests aeolian or a mixture of fluvial-aeolian origin.

Furthermore, intense gypsum cementation (whether amorphous or crystalline) widely affects this superficial sandy silt layer. Some gypsum is dispersed into the soil filling the interstices while some others fill the existing fissures, giving rise to vertical aligned gypsum bodies several centimetres thick, associated with geological structural directions.

The intense salty enrichment seems to have happened after soil sedimentation, and it is likely that contamination of sandy silty layer may also come (at least partially) from aerial contamination; this phenomenon is currently ongoing.

It should be noted that the superficial sandy silt layer does not always sit directly on the gravel bodies but sometimes sand layers are located in between. Given the lower content of gypsum and the higher compactness of this sand layer, it is thought that they are in fact horizontal transitions from gravel bodies, linked in some way to fluvial dynamics (such as gravel bodies) more than to the fluvial-aeolian presumed origin of the superficial sandy silt layer.

It should be noted that the sand layer sometimes identified between the defined sandy silt body and the sandy-gravel body, is not represented in sections as it was not possible to define this appropriately, and therefore it will be somewhere over the sandy silt and gravel contact.

In the valley of the Zarafshan River, the groundwater is confined to alluvial-proluvial gravel formation with an aquifer thickness of up to 50m. Nevertheless, no groundwater was identified in surveys carried out to a depth of 8.8 meters. It can therefore be concluded that no groundwater would be encountered during construction works.

6.3.2.4 Seismicity

For the purposes of seismic resistant design, Uzbekistan has issued the code KMK 2.01.03-96 “Norms and Regulations for Construction in Seismic Zones” and KMK 2.07.01-94 “Town planning, lay-out and building of urban and village settlements “

According to the seismic code, the project site is located between zones 7 and 8. The intensity and return period of earthquakes with probable intensity above VII are provided in this design code, where Navoi has an intensity of VII with 100 years of return period.

In the context of the Global Seismic Hazard Assessment Project (GSHAP), a seismic hazard distribution map of Uzbekistan was extracted from the global seismic risk data. The resulting map contains the global distribution of the Peak Ground Acceleration (PGA), expressed in m/s2, with a 10% chance of exceedance (90% chance of non-exceedance) for an exposure time of 50 years and a corresponding return period of 475 years.

The project site is located between medium seismic hazard (PGA=0.8 - 2.4 m/s2) and high seismic hazard (PGA=2.4 - 4.0 m/s2) and 475 years of return period.

6.3.3 Hydrology and hydrogeology

6.3.3.1 Regional

The Zarafshan river is the only permanent, natural surface water flow in the Navoi province. The river is glacier-snow fed. According to national reports, the water quality of the Zarafshan river has deteriorated as a result of irrigation returns and wastewater discharges from residential areas. A comparative sampling survey undertaken in the Zarafshan river (1 km upstream and 0.5 km downstream the city of Navoi) showed that activity in the area contributes to a deterioration in water quality, particularly in relation to levels of suspended solids, ammonia, oil, sulphate, sodium, phosphate, copper, zinc, chromium and lead. This could be representative of the two canals located in close proximity to the boundary of the proposed project site.

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

- Zarafshan River – ~5km N of the proposed site
- Skurkulshoe Reservoir – ~25km N of the proposed site
- Navoi Canal – ~9km SE of the proposed site.

The Zarafshan is the third largest river of Uzbekistan. It originates at 2,750 m a.s.l. and is glacier fed. The total river basin covers an area of 4,000 km^2, the river length is 781 km. At its source the river is known as Mostchokh-Darya. Further downstream, after taking several tributaries, the name is changed

to Zarafshan. For the first 300 km the river flows through Tajikistan, then it enters Zarafshan Valley, situated in the Samarkand region of Uzbekistan. In its whole catchment the Zarafshan receives 70 tributaries.

Figure 6-6: Zarafshan River north of the Project site

Figure 6-7: Zarafshan River north of the Project site (2)

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). In the Samarkand and Navoi regions 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. In the past the river disappeared 20 km short of connecting with the Amu-Darya.

6.3.3.2 Local

Two canals form the eastern and western boundary of the site. Based on information gathered during consultation, the canals are for drainage purposes only (i.e. they collect water from upstream agricultural fields at the south), there are no other additions (e.g. treated or untreated industrial, domestic or other streams) and there are no downstream users of the canal.

To the immediate west of the project site boundary is an area of more naturalised run off which discharges into the Shafirkanskaya Vetka Canal and which in turn discharges into the Zarafshan River. It is noted that the Zarafshan River is significantly altered downstream of Khasancha and water is abstracted to the Dzalvan Canal to irrigate large areas of farmland. As a result, a significant fuel or oil spill entering the Zarafshan River has the potential to impact on a large geographical area.

6.3.3.3 Water Quality

The water quality in the river has deteriorated under the impact of the return water from irrigation and waste waters from towns, such as Samarkand, Kattakurgan and Navoi. Water salinity in the river increases from 0.27 g/l at its source to 2.4 g/l at its mouth. 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. The river water is classified as having a medium level of pollution.

A chemical analysis of the water of adjacent drainage channels was performed in January 2019 and it concluded that surface waters are characterized as brackish water, with high levels of chlorides and sulphates. The table below shows the chemical analysis results.

Table 6-2: Water analysis results (National Standards)

Parameter	Maximum Permissible Concentration	Location A (mg/l)	Location B (mg/l)	Status
HCO_3	-	183	164	N/A
Cl^-	300	420	378	Not compliant
SO_4	100	1793	199	Not compliant
Ca	180	460	590	Not compliant
Mg	40	120	144	Not compliant
Na+K	-	445	314	Not compliant[22]
Na	120	-	-	-
K	50	-	-	-
pH	6.5-8.5	7.6	7.6	Compliant

Based on the test results, the water has a high degree of hardness and corrosivity. The mineralization of tested water exceeds the limits set out in the Uzbek maximum permissible concentrations. Therefore, the water resource is not likely to be of sufficient quality, without further treatment, for use as drinking water and will be corrosive to concrete and piled foundations. The suitability of the water for this and other purposes such as cleaning will be investigated further during the full ESIA study.

6.3.3.4 Groundwater

No groundwater was found in the surveys carried out. None of the pits or dynamic penetrometers have found free water or wet areas. No groundwater level has been identified in the borehole. As shown in the Hydrogeological map of Uzbekistan (scale 1:500.000) edited in 1998, the groundwater level is located at about 290m ASL; with the plot altitude between 310 and 320 m ASL, it is concluded that the water table is located more than 20 meters below the plot surface. Furthermore, extensive groundwater pumping is still going on the area, therefore deeper water is now expected. Discussion with the Khokimyiat suggested that groundwater is present at a depth of 80m below ground level. Previous studies suggest that groundwater is non potable and would require some form of treatment prior to use.

6.3.3.5 Flood Risk

A full hydrologic and hydraulic study[23] was carried out by TYPSA and according to the available data there is no flooding risk in the site of the project related to extreme flows of the Zarafshan River. This conclusion is consistent with the geographical information (distance and elevation difference between the project site and the river).

A theoretical Intensity-Duration-Frequency (IDF) curve estimation has been performed in order to analyze flooding risk in the southern basin, where the site of the project is partially included. According to the analysis performed, there is no flood risk in the project site related to extreme rainfall events on

[22] Note analysis results provided total concentration of Na plus K whilst MPC provides separate limits for Na and K. Given the concentrations recorded either one or both parameters are in exceedance of MPC.
[23] Typsa (2019). Scaling Solar Uzbekistan: Hydrology and Hydraulic Report. Ref. SP5331-RP-HE-HydrologyReport-00-D02

the southern drainage basin: Calculated maximum water elevations are below 296 masl and terrain elevation of the site is above 300 masl.

Although there is no risk of flooding related to the increase of flowrates of the natural drainage systems where the site is located, an appropriate drainage network should be considered in order to properly drain runoff generated inside the site of the project.

6.3.3.6 Water Resources

The following sources of water have been identified that may be able to meet the project's potential construction and operational needs:

1. Drainage canal located at the east of the proposed site: this stream is drainage from upstream agricultural areas and there are no users downstream that could be affected if the project obtains water from this canal. As reported during the consultation meetings, the canal carries sufficient flow during the year to provide the annual water estimates. The use of this water will require a permit from the Irrigation and Land Improvement Department. No permit from a local institution is required. Water quality results are provided in Table 6-2 above.
2. Superficial groundwater (>20 m deep) is not used for agriculture as the salt content high as reported by the Environmental department. As discussed during consultation, no permit is required to abstract groundwater level from the superficial table. There is a deeper groundwater body (it was reported that there is an impermeable level and a confined aquifer at approximately 80m depth underneath) and a permit is required (provincial level Environmental Department) to abstract water from this deeper interface. A water purification unit may be required if this solution is adopted.
3. Direct abstraction from the Zarafshan River. The use of this water will require a permit from the Water Management Directorate. A water purification unit may be required if this solution is adopted and the level of treatment would be determined by the water quality requirements for concrete and panel washing. However, it should be noted that seasonal water constraints were reported during the meeting with the Environmental Department and this option is not recommended to meet operational needs.

In all cases, the chemical analysis of the drainage water shows that a treatment plant will have to be installed if this water is used for PV module cleaning.

6.3.4 Utilities

In addition to the water channels, a drinking water pipeline has been identified adjacent to the project Site.[24] AECOM carried out further investigation during March 2020 and identified a pipe crossing at the drainage canal to the west of the site (Figure 6-9). Discussion with the Hakimiyat suggests the pipe is a water pipe constructed around 2015 or 2016. It was also suggested that responsibility for the pipe did not reside with the Navoi Hakimiyat but with Samarkand. An additional survey was completed by AECOM which confirmed the route of the pipe and also confirmed that the official drawings were substantially inaccurate. The water pipeline is operational. The figure below shows the confirmed pipeline routing in red.

[24] Refer to the topographic drawing for the pipe routing

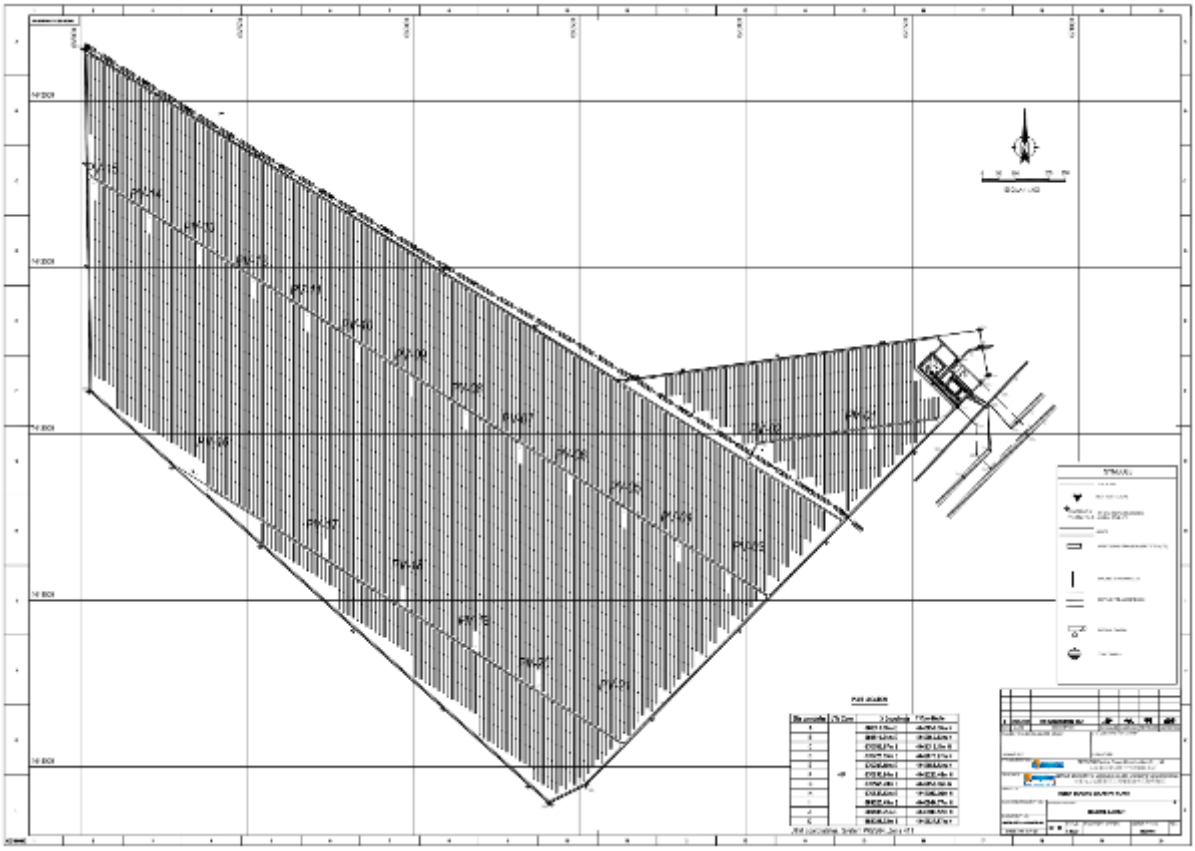

Figure 6-8: Plan showing route of water pipe in dotted line (confirmed)

Figure 6-9: Water pipe crossing (March 2020)

Figure 6-10: Location of Water pipe crossing (March 2020)

6.3.5 Air Quality

Current sources of air pollution in the vicinity of the Project site include the burning of fuels in surrounding communities and vehicular traffic along neighbouring roads.

Dust conditions were low (not discernible) at the proposed site on the days of the site visits. The likelihood of dust storms is low as reported by the Environmental Department during the consultation meetings. No stationary emitting sources were identified in the surrounding areas of the proposed site. The closest emitting sources were the vehicles using the M37 road. The operational coal fired power station is 28km to the east of the Project. The main source of air pollution will be dust during construction works and the receptors will be the two farms identified as well as the settlement of Uzumor, 2km to the east.

6.3.6 Noise, Vibration and Light

Current anthropogenic noise in the vicinity of the Project site is related to agricultural and domestic activities, as well as vehicular traffic along the M37 road to the south of the site. Natural noise sources include noise from birds and insects. There were no significant sources of vibration noted during the site visits. The area is also generally not illuminated at night.

6.4 Landscape and Visual

6.4.1 Introduction

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

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

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

6.4.2 Baseline Data Collection

6.4.2.1 Study Area

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 shown on Figure 6-11 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.

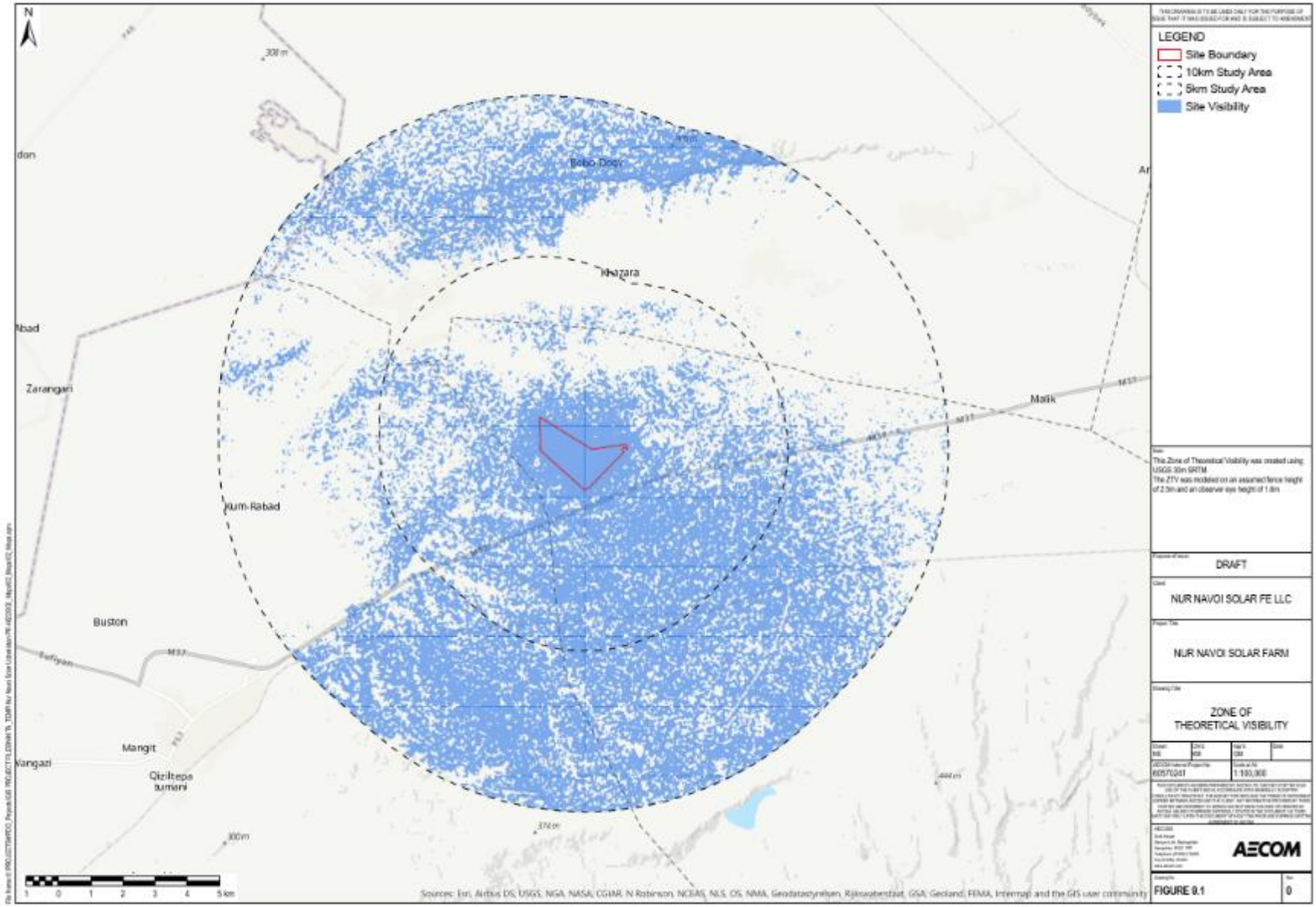

Figure 6-11. Zone of Theoretical Visibility and Landscape Study Area

6.4.2.2 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.

The visual assessment is based on 7 viewpoints which have been selected to represent the experience of the different types of visual receptor where significant visual impacts are most likely to result.

6.4.3 Current Landscape Condition

The Project is located on flat open plain enclosed by the Zarafshan river to the north and highway M37 to the south. A general view of the site is shown on Figure 6-12**.** The only features of interest within the site and immediate surroundings are a single tree and the two farms to the north and south. OHLs are clearly visible to the south.

Figure 6-12. Site Context

The region is semi-arid and land cover within the Site and immediate context is predominantly scrub grassland. Settlements are small, comprising nucleated villages and isolated farmhouses, connected by the M37 highway and an informal network of smaller tracks. Agricultural land tends to surround settlements. The largest nearby settlement, the village of Uzumzor, is 2.8 km east of the Project. Land surrounding the village is irrigated agricultural farmland and rough grazing. Existing electrical infrastructure including three overhead lines are located immediately east of the Site.

6.4.3.1 Landscape Character Areas

Desk based analysis has identified three Landscape Character Areas within the 10 km study area. The description, key characteristics, likely trends and consideration of landscape value of each are detailed below. Project Landscape Character Areas are described in Table 6-3.

Table 6-3. Project Landscape Character Areas

LCA	Description
LCA 01 Zarafshan River	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. There are a number of important archaeological sites however these have often been damaged by more recent construction. For example, constructing overhead lines and pylons on the wall of a former fortress. Overall the landscape value of LCA 01 is considered to be **low**.
LCA 02 Semi Arid Plains	This LCA contains relatively commonplace steppe landscape features. The backdrop to this LCT is the city of Navoi to the east and this has a considerable influence on the scenic quality. The detracting influence of industrial developments including an electricity substation, widespread pylons and overhead lines result in an overall landscape value which is considered to be **low**. The landscape quality improves considerably to the south of the hills to the south of the project area however the hills create a natural barrier limiting the extent of LCA 02.
LCA 03 Uzumzor and Agricultural Farmlands	This LCA is largely a transition between LCA 02 and the more industrial LCA 04. The LCA is characterised by medium sized agricultural fields and irrigation channels associated with the residential edge of Uzumzor and surrounding villages. Views towards the industrial facilities including Navoi Cement Plant (26km east south east) and Navoiyskiy Elektro-Khimicheskiy Zavod (22km east south east) and overhead lines crossing this LCA significantly reduces the scenic quality of this LCA. As such the landscape value in this LCA is **low**.
LCA 04 Navoi and Environs	This LCA incudes the main settlement of Navoi but more importantly the industrial developments surrounding the city. This includes a coal fired power station (28km east south east), visible flaring (>30km east south east) and Navoi Cement Plant emitting yellow/brown smoke from the main stack (26km east south east). In addition, there are significant amounts of pylons, overhead lines and pipelines visible above ground. The setting is almost completely industrial and as a result the landscape value is **low**.

Representative views from the above LCTs are shown in the below figures.

Figure 6-13. Core Area of LCT 01 Zarafshan River

Figure 6-14. Core Area of LCT 02 Semi Arid Plains

Figure 6-15. LCA 03 Uzumzor and Agricultural Farmlands

Figure 6-16. LCA 04 Navoi and Environs – View of Coal Fired Power Station from the M37

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6.4.3.2 Zone of Theoretical Visibility

A computer generated ZTV map has been prepared for the Project, to assist the assessment process. This has been used to inform the selection of representative viewpoints and to illustrate the potential influence of the Project in the wider landscape. The ZTV map indicates areas from where it may be possible to view part of or the entire Project. However, the use of the map needs to be qualified by the following considerations:

- The ZTV has been generated using ALOS WORLD 3D Digital Surface Model at 5 m horizontal resolution assuming the observer eye level of 1.6 m;
- The ZTV mapping is limited by the detail of the digital terrain model data used and does not take account of local topographic variations or screening from built form or vegetation;
- Some areas of theoretical visibility may comprise woodland, upland or agricultural land, where there is effectively no public access and the likelihood of views being experienced is consequently low; and
- The ZTV does not take account of the likely orientation of a viewer, such as the direction of travel and there is no allowance for reduction of visibility with distance, weather or light.

These limitations mean that the ZTV map tends to overestimate the extent of the visibility, both in terms of the area from which the Project is visible and the extent of the Project, which is visible. It should be considered as a tool to assist in assessing the theoretical visibility of the Project and not a measure of the visual effect.

The ZTV shows widespread visibility of the Project in the area south of the project site to the mountains with some visibility to the north of the Zarafshan River. There are pockets where there is no visibility due to landform.

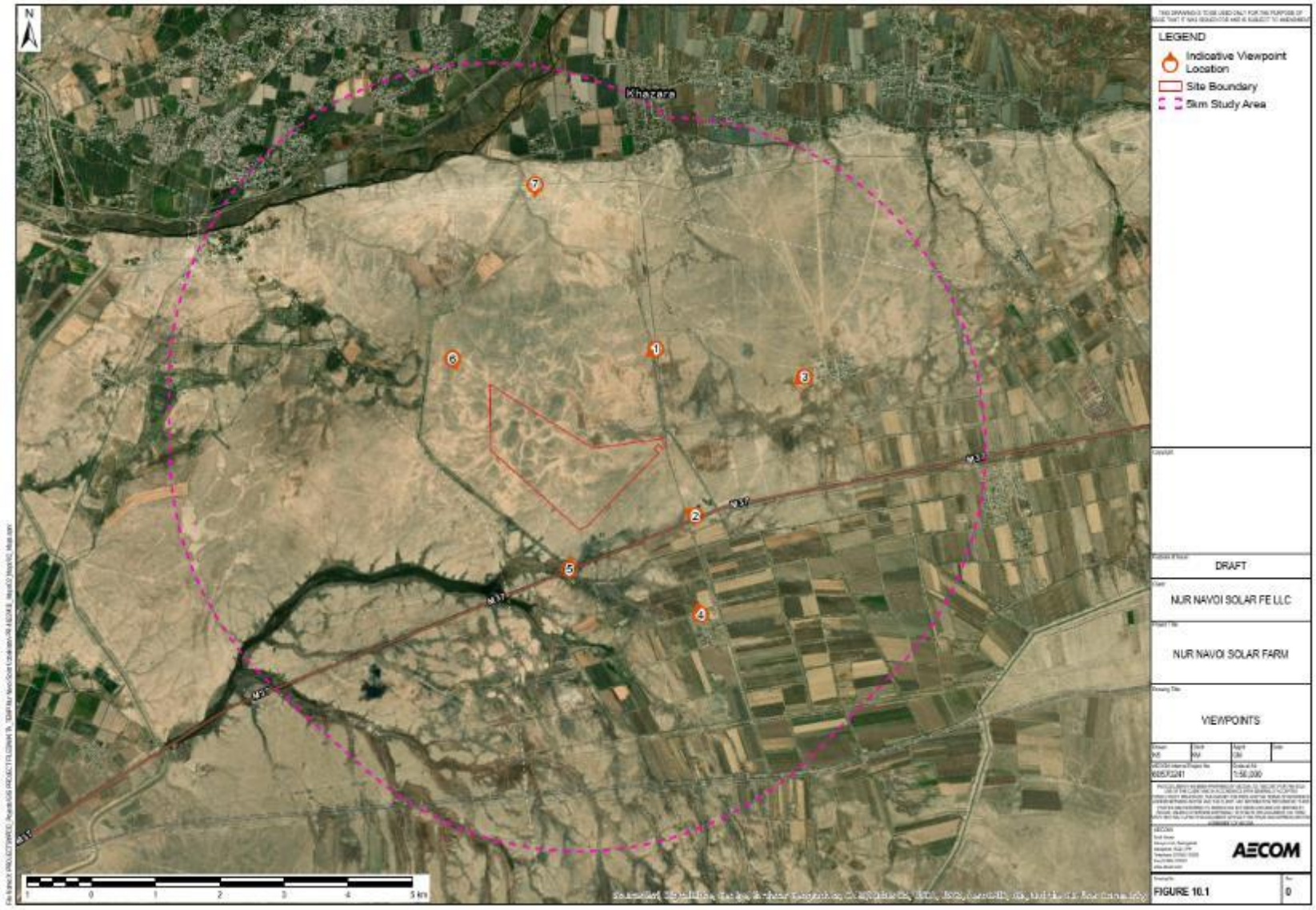

Figure 6-17. Viewpoints

6.4.3.2.1 Visual Receptors

Visual receptors within the scope of this assessment are described in the following section and are grouped into the following categories:

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

There are a number of settlements and scattered properties within the study area where residents experience a range of views that have the potential to be affected by the Project. Uzumzor is a village approximately 2.5 km east of the Project and would experience open, expansive views towards the Site from the western extents of the village. In addition, there is a small settlement 2.5km to the south of the Site where the nature and focus of views is varied. The network of informal tracks that is occasionally used for access will experience varying views. Of wider importance are the religious and cultural sites on the Silk Road including the Deggaroni which has attracted visitors from as far afield as the UK.

6.4.3.2.2 Representative Viewpoints

A total of seven representative viewpoints have been selected based on the visual receptor criteria above and where the Project is likely to affect views. Representative viewpoints are shown on Figure 5-10. The baseline description and value judgment for each is detailed in Table 6-4 below.

Table 6-4. Viewpoint Descriptions

Viewpoint ID	Location	Representative Receptors	Description
Viewpoint 1	1.5 km north of the nearest part of the Project Site boundary	Access road	This viewpoint is representative of residents travelling from Khazara to the M37 highway and potentially visitors to the Deggaroni. The foreground of the view is enclosed by a 2 m high earth wall formed by the excavation of the drainage canal running parallel with the road. The earth wall effectively limits views to the road and immediate foreground. The number of electrical cables and transmission towers forms the predominant vertical features of this view. As the viewer approaches the M37 road the pylons become the dominant feature of the view. As noted, views of residents will be partially restricted by the topography, vegetation and earth wall and therefore the visual value is considered to be **low**.
Viewpoint 2	1 km south east of the nearest part of the Project Site boundary	Highways receptors	This viewpoint is similar to VP 1 that it is representative of residential receptors travelling to Khazara from the M37 highway and potentially visitors to the Deggaroni. The foreground of the view is generally open towards the Project and the dominant features in the foreground are the overhead lines and pylons. The number of electrical cables and transmission towers forms the predominant vertical features of this view. The views experienced will be transient as there are no residential properties in this area. As noted, views of residents will be partially restricted by the topography, vegetation and earth wall and therefore the visual value is considered to be **low**.
Viewpoint 3	2.5 km east of the closest part of the Project Site boundary	Residential receptors	The view, looking south west of the project, is representative of residents in the Uzumzor area. The foreground is comprised of areas of cultivated ground and the main M37 highway which is the primary route between Samarkand, Navoi and Bukhara. The middle ground is largely comprised of the earth wall on the edge of the drainage canal and the minor road, that runs across the majority of the view, along with a mix of scattered electrical poles. Long distance views of transmissions towers can be seen creating vertical lines on the skyline. There is considerable screening provided by the existing topography therefore the visual value is considered to be **low**.
Viewpoint 4	2.5 km south of the Project Site boundary	Residential receptors	This view is representative of residential receptors in a small cluster of dwellings, illustrates views to the south of the Project. The view is flat, with expansive panoramic views, comprising of cultivated fields in the foreground. The vast landscape is disturbed by human influence and there is a line of farm buildings which distinguish between the foreground and middle ground. A few scattered remnants of low-level structures/ materials and field boundaries can be seen in the background. Transmission towers create vertical lines in the skyline. Due to the distracting elements of the view, the visual value is considered to be **low**.
Viewpoint 5	1 km south west of the Project Site boundary	Highways Receptors	This viewpoint is similar to VP 1 and 2 that it is representative of receptors travelling on M37 highway and potentially visitors travelling to the Navoi area. Views would only be experience by receptors travelling east from the direction of Bukhara. The foreground of the view is generally screened by a central reservation and bridge/fencing on the road verge. In keeping with other VPs, views are fairly open towards the Project but the dominant features in the foreground are the overhead lines and pylons. The number of electrical cables and pylons forms the predominant vertical features of this view. The views experienced will be transient as there are no residential properties in this area. At this location distant views of the oil refinery and industrial facilities become visible in an east southeast direction. The visual value is considered to be **low**.
Viewpoint 6	<1 km west of the Project Site boundary	Residential receptors	The view is looking east towards the Project along a dirt track, representative of a single farm property and road users who are likely to be resident of the nearest villages further to the west. The foreground of the view is flat, open with wide angle views, comprising

Viewpoint ID	Location	Representative Receptors	Description
			of areas of steppe, with areas of small shrubs but with pylons and overhead lines in the whole view. The middle ground comprises of a continuation of steppe rising to a higher point in the middle ground before dropping down the M37 and becoming hidden from view at this VP. The background of this view is framed by distant hills. The pylons and overhead lines are the primary focus of the view due its contrasting colours and vertical height with the surrounding flat, open landscape and therefore the visual value is considered to be **low**.
Viewpoint 7	5 km north of the Project Site boundary	Residential / recreational receptors	The view is representative of residents of Khazara and tourists visiting the Deggaroni or ruined fort along a minor tarmac road which is in poor condition. This illustrates views to the north of the Project. The foreground of the view is relatively flat, open and rising in elevation, comprising of overgrazed steppe vegetation. The elevated ground creates a ridge in middle ground which effectively screens views of the Project. The key features at this location are the pylons and overhead lines however the ruined fort and Deggaroni are visible at this location but behind the viewer. The comparable scale of the vertical structures tends to focus views to immediate foreground and with the screening effect of topography the visual value is considered to be **low.** Views of cultural sites are in the opposite direction of the Project therefore the Project would not alter the views experienced of those sites.

Figure 6-18. Viewpoint 1

Figure 6-19. Viewpoint 2

Figure 6-20. Viewpoint 4

Figure 6-21. Viewpoint 5

Figure 6-22. Viewpoint 6

Figure 6-23. Viewpoint 7

6.5 Biodiversity

6.5.1 Overview

The project site is dry steppe but is surrounded by irrigation canals, lakes and watercourses which have the potential to attract a wide range of species. In particular, the likelihood of the Project site being used as a stopover site for migrating birds has been investigated. 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.

6.5.2 Site Survey Methodology

The ecological baseline (habitat identification, floral survey, terrestrial fauna and avifauna survey) was established AECOM ecologists during site surveys on 3rd, 4th, 5th and 6th March 2020. The surveys included:

- Walkover transect surveys for birds, reptiles, mammals and rare and endemic species of plants within the proposed project site;
- Walkover transect survey for habitat assessment categorization within the proposed project site;
- Drive-over and point count surveys for the aforementioned ecological features adjacent to the proposed project site.

The site footprint (being relatively small) was surveyed on foot with a series of transects running from east to west or north to south. The area was traversed in a regular pattern in order to reduce the chances of missing any important biotic features.

A further ecological survey is programmed for the week commencing 22 June 2020.

6.5.2.1 Vegetation Study

The aims of the March 2020 vegetation study were to:

- Determine the species present at and around the proposed Project site and highlight any protected or IUCN Red Data listed species.
- Identify any exotic or potentially invasive flora species.
- Describe the potential direct or indirect impacts, whether they are beneficial, adverse or neutral, on the current vegetation communities or protected species as a result of the construction and operation of the proposed Project.
- Provide feasible mitigation strategies as counter measures for the potential impacts.

Plant species were identified, and distributions were checked using relevant literature. The conservation status of each of the plant species documented was researched using the IUCN data bases. This was cross checked against the Uzbek Red List to determine the presence of species of conservation importance.

6.5.2.2 Terrestrial Fauna Study

The aims of the faunal study were to:

- Carry out field work to identify the terrestrial fauna that may reside or range within the region of the proposed Project.
- Provide detailed lists of the mammal, reptile, and amphibian fauna in the region.
- Provide the IUCN Red Data rating and protected status in Uzbekistan for each of the fauna species determined to be present or potentially occurring at the site.
- Identification of any direct or indirect impacts, whether they are beneficial, adverse or neutral, on the current terrestrial biodiversity and provide relevant mitigation measures.

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

6.5.2.3 Avifauna Survey

The aims of the March 2020 avifauna survey were to:

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

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

Residence status:

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

6.5.3 Habitats

The vegetation of Uzbekistan is divided into four main ecosystems (Belolipov *et a*l, 2013)[25]; the proposed Project site is located in the Chal zone (arid plain, desert).

The March 2020 AECOM surveys confirmed that *Artemisia* associations predominate in the proposed Project site (referred to as 'wormwood steppe' herein). Wormwood steppe communities are ubiquitous within the arid zones of Uzbekistan. Other plant species recorded within this community include frequent isirik (*Peganum harmala*), frequent broad-leaved grasses (eg. *Poa* spp.), occasional thistles (*Asteraceae*) and occasional tulip (*Tulipa buhseana*). The wormwood steppe within and adjacent to the site is heavily influenced by grazing by goats. This habitat is considered to be degraded Natural Habitat as defined in PS6.

There are localised areas of the wormwood steppe within and adjacent to the northern and eastern boundary of the site which have been modified by historic cultivation. The cover of *Artemisia* is reduced and the saline soils which typify these areas support frequent Yantok (*Alhagi maurorum*) and rare tamarisk (*Tamarix* spp.). The wormwood steppe is considered to be Modified Habitat (recently or currently used for agricultural/farming/pastoral activities)

The wet irrigation ditches which border the proposed Project site support linear stands of dominant common reed (*Phragmites australis*).

The proposed Project site and adjacent areas do not fall into Critical Habitat category (as defined in the PS6). The spatial locations of the aforementioned areas of degraded Natural Habitat and Modified Habitat within the AOI will be confirmed during further botanical and habitat surveys programmed in late June 2020. A key aim of

[25] Belolipov, I.V., Zavrov, D.E. and Eisenman, S.W. (2013). The Geography, Climate and Vegetation of Uzbekistan. *Medicinal Plants of Central Asia; Uzbekistan and Kyrgystan, pp.5-7*

these further surveys will be identify any plant species listed on the Uzbekistan Red List and invasive non-native species.

6.5.4 Protected Areas

There are several Key Biodiversity Areas (KBAs) within 50km buffer surrounding the project site. The closest of which is the Tudakul and Kumazar Reservoirs located 20km to the southwest of the project site.

- Tudakul and Kuymazar Reservoirs – ~20km SW of the proposed site
- Kagan Fish Farm – ~45km SW of the proposed site (adjoined to Tudakul KBA)
- Dzheiran Ecocentre – ~45km SW of the proposed site (adjoined to Tudakul KBA and Kagan Fish Farm KBA).
- Karnabchul Steppe – ~50km SE of the proposed site.
- Vardanzi IBA – ~45km W of the proposed site.
- Sarmish Nature Park – ~60km NE of the proposed site

Given the distance from the Protected Sites to the Project it is considered that only the species using the Tudakul and Kuymazar Reservoirs may potentially interact with the Project. It is considered that this interaction would be a result of species using habitats on site for breeding or feeding.

The Tudakul and Kuymazar IBA is situated in the southwestern part of the Kyzylkum Desert and includes Lake Tudakul, a small swamp and Kuyu-Mazar Reservoir. Lake Tudakul is situated 23 km NE of the town of Bukhara and Kuyu-Mazar Reservoir 1 km NW of Tudakul. The water in Tudakul is saline. Kuyu-Mazar Reservoir was created to provide the areas situated in the arid zone with drinking water. the western and northern parts of Lake Tudakul are free of any shoreline vegetation; the south and eastern parts are overgrown with reeds and tamarisk, from 10-15 to 150-200 m in width. The lake is more or less spherical, its average width is 30 km, average depth reaches 5-8 m. The western part of the lake has a high and precipitous coast. Beyond it is a marshland with isolated waterbodies surrounded with reed. Several open islets rise in the central and northern parts of the marshland. The water is the reservoir is fresh. High islets and promontories occur in the central and northern parts, which shelter cormorants, gulls and birds of prey. The shores are mainly stony and precipitous; they are practically free of vegetation. Flat coasts are overgrown with halophytes and saltwort. Although only a few sites have been formally proposed under the A3 biome-restricted criteria (for biome CA04b Eurasian Desert and Semi-desert), many of the IBAs in the Kyzylkum Desert region support populations of biome-restricted species and, effectively, form a network of sites throughout the area.

No special studies of the avifauna of Lake Tudakul and adjoining areas have ever been carried out, but the fauna of the desert part of Bukhara province and its water bodies is well explored. More than 250 bird species have been recorded there. Both pelican species are recorded during migration and Dalmatian Pelican winters, as well as two species of Cormorant. In these seasons, five species of Podiceps; 4 species of Pelecaniformes; 12 Ciconiiformes; 1 Phoenicopterus; 23 Anseriformes; 18 Falconiformes; 5 Rallidae; 2 species of cranes; 29 shorebirds and 14 Laridae have been recorded. The wetland avifauna has developed comparatively recently with the development of reedbeds and formation of conditions suitable for habitation. Therefore, the numbers of nesting birds are on the increase but have not been evaluated fully. Three species of rare birds included in the IUCN Red List nest - *Oxyura leucocephala, Marmaronetta angustirostris and Aythya nyroca. Pelecanus crispus, Branta ruficollis, Anser erythropus, Haliaeetus leucoryphus* and *Chlamydotis undulata* are recorded on migration and wintering. There are also four species included in the national Red Data Book nesting - *Platalea leucorodia, Plegadis falcinellus, Egretta garzetta* and *Phalacrocorax pygmaeus*. *Pelecanus onocrotalus, Cygnus olor, Pandion haliaetus, Haliaeetus albicilla, Aquila nipalensis, Falco peregrinus* and *Larus ichthyaetus* are migratory and wintering Red Data Book species. This territory is of international importance for the sustainability of migratory and wintering waterbirds. In winter 2000, 55.345 birds were recorded during the aerial count. In 2003, during the terrestrial counts, were recorded 143.392 waterbirds in 2003; in 2004, 168.533 birds; in 2005, 96.358 birds.

The following mammals have been recorded: *Vulpes vulpes, Vulpes corsac, Felis lybica, Mustela eversmanni, Vormela peregusna, Meles meles*; of rodents, *Rhombomys opimus, Meriones tamariscinus, Ellobius tancrei, Nesokia indica, Allactaga elater, A. severtzovi and Spermophilus fulvus* are resident; *Lepus tolai* and *Hemiechinus auritus* are common. In recent years, the introduced *Ondatra zibetica* and *Myocastor coypus* have been noted. Amphibians are represented by *Rana ridibundus* and *Bufo viridis*. Reptiles are represented by *Agrionemys horsfieldi, Natrix tesselata, Coluber karelini, C. ravergieri, Erix miliaris, Psammophis lineolatum, Phrynocephalus*

helioscopus, Phrynocephalus interscapularis, Eremias lineolata, Eremias scripta, Trapelus sanguinolentus, Cyrtopodion caspius and Teratoscincus scincus. The fish fauna is comprised of 10 species. The flora has not been studied in detail, but it includes species typical of wet parts of the desert areas of Bukhara.[26]

6.5.5 Flyways

The Central Asian Flyway (CAF) covers a large continental area of Eurasia between the Arctic and Indian Oceans and the associated island chains. The Flyway comprises several important migration routes of waterbirds, most of which extend from the northernmost breeding grounds in the Russian Federation (Siberia) to the southernmost non-breeding (wintering) grounds in West and South Asia, the Maldives and the British Indian Ocean Territory. The birds on their annual migration cross the borders of several countries.

Geographically the flyway region covers 30 countries of North, Central and South Asia and Trans-Caucasus (including Uzbekistan).

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

Uzbekistan's natural and artificial wetlands are important for migrating and overwintering waterfowl (Lanovenko 2006). More than 50 migratory waterbird species have been recorded on Uzbek wetlands, including at least nine which are globally threatened: Dalmatian Pelican *Pelecanus crispus*, Lesser White-fronted Goose *Anser erythropus*, White-headed Duck *Oxyura leucocephala*, Ferruginous Duck *Aythya nyroca*, White-tailed Eagle *Haliaeetus albicilla*,Red-breasted Goose *Branta ruficollis*, Marbled Teal *Marmaronetta angustirostris*, Pallas's Sea Eagle *Haliaeetus leucoryphus* and Pygmy Cormorant *Phalacrocorax pygmaeus*.

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Notable migratory species potentially using the flyway in the vicinity of the project area include the White-headed Duck and Sociable Lapwing (see further information under 'Species of Concern' below).

6.5.6 Avifauna

Uzbekistan has a total of 352 bird species with 19 listed as globally threatened. 297 species are migratory with 55 resident species. No species are listed as country endemics.[27]

One avian species categorised as Critically Endangered has been identified (IBAT 7 tool – using a 50 Km buffer) - *Vanellus gregarious*. The Tallymerjan area on the Uzbekistan/Turkmenistan border (approx. 140km south of the project area) has been highlighted as a key stopover site for the eastern flyway, with all birds monitored on the eastern flyway using this site as a stopover site during their migration. It is possible that birds fly over the proposed project site. It is also therefore possible that birds could use habitat surrounding the project as stopover sites during migration.

Table 6-5: Globally threatened bird species

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

[26] BirdLife International (2020) Important Bird Areas factsheet: Tudakul and Kuymazar Reservoirs. Downloaded from http://www.birdlife.org on 03/02/2020
[27] BirdLife International (2020) Country profile: Uzbekistan. Available from http://www.birdlife.org/datazone/country/uzbekistan. Checked: 2020-02-03

Scientific Name	Common name	Family	IUCN Category
Streptopelia turtur	European Turtle-dove	Columbidae (Pigeons, Doves)	VU
Leucogeranus leucogeranus	Siberian Crane	Gruidae (Cranes)	CR
Otis tarda	Great Bustard	Otididae (Bustards)	VU
Chlamydotis macqueenii	Asian Houbara	Otididae (Bustards)	VU
Vanellus gregarius	Sociable Lapwing	Charadriidae (Plovers)	CR
Numenius tenuirostris	Slender-billed Curlew	Scolopacidae (Sandpipers, Snipes, Phalaropes)	CR
Neophron percnopterus	Egyptian Vulture	Accipitridae (Hawks, Eagles)	EN
Clanga clanga	Greater Spotted Eagle	Accipitridae (Hawks, Eagles)	VU
Aquila nipalensis	Steppe Eagle	Accipitridae (Hawks, Eagles)	EN
Aquila heliaca	Eastern Imperial Eagle	Accipitridae (Hawks, Eagles)	VU
Haliaeetus leucoryphus	Pallas's Fish-eagle	Accipitridae (Hawks, Eagles)	EN
Falco cherrug	Saker Falcon	Falconidae (Falcons, Caracaras)	EN

6.5.6.1 Species of Concern

Sociable lapwing – *Vanellus gregarious*

The sociable lapwing is a strikingly patterned plover species listed as Critically Endangered (CR) by the IUCN.

It is listed as CR due to recent dramatic declines in population size across its range, with an estimated 5,600 pairs remaining globally. It is thought that illegal hunting during migration and on wintering grounds may now be the species primary threat, although the reasons for its recent decline are poorly understood (Birdlife International, 2018).

The species breeds in Northern Kazakhstan during the summer months, and a large percentage of the population flies south-west to spend the winter in Syria and Sudan between September and March. A recently discovered migratory population however migrate to the east to winter in Pakistan, crossing Afghanistan, Turkmenistan and Uzbekistan on their journey, and resting at stopover sites along their route (Birdlife International, 2018).

The Tallymerjan area on the Uzbekistan/Turkmenistan border (approx. 140km south of the project area) has been highlighted as a key stopover site for the eastern flyway, with all birds monitored on the eastern flyway using this site as a stopover site during their migration. This indicates that one third of the global population may be using this site.

Consultation with ecologists from the Emirate Centre for the Conservation of the Houbara (ECCH) at the Uzbekistan ECCH headquarters (to the east of Lake Tudakul) undertaken during the March field survey visit confirmed that low numbers of sociable lapwing utilise the steppe habitats associated with the hinterland of Lake Tudakul IBA as a stopover site during their migration (a single bird was recorded in 2019 and this species prefers wet steppe habitat [ECCH, pers comm]).

It is possible that birds fly over the proposed project site (see map below of tracked birds in 2015). It is also therefore possible that birds could use habitat surrounding the project as stopover sites during migration, however there is no reasonable likelihood that the proposed Project site is a stopover site for this species considering the relatively small size of the steppe habitat which is ubiquitous throughout the region and the relative remoteness from the known stopover site associated with Lake Tudakul IBA. Additionally, the dry steppe habitat within the proposed Project site is less favourable for this species compared to wetter areas of steppe and cultivated habitat in the wider landscape.

White headed Duck – *Oxyura leucocephala*

Listed as endangered by the IUCN, this duck species is known to occur in Uzbekistan. It usually occurs within larger wetland systems where there are semi-permanent freshwater, brackish or eutrophic lakes with a fringe of

emergent vegetation (BirdLife International, 2019). Major threats include the drainage of appropriate habitat and hybridisation with the north American ruddy duck. It is noted to be present at the Tudakul and Kuymazar Reservoirs and Kagan Fish Farm KBAs. It is a migratory species.

Steppe Eagle - *Aquila nipalensis*

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

Saker Falcon - *Falco cherrug*

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

Pallas' Fish Eagle - *Halieetus leucoryphus*

The project area is within the native non-breeding range of this species displayed on the IUCN red list. The species is closely linked to wetland, reservoirs and lake habitats and nests in trees near these water bodies.

The eagle is listed as Endangered largely due to the continued loss and disturbance of wetland and breeding sites across its range, and there are now thought to be between 1000-2499 mature individuals globally. It is listed as a species that occurs at the Kagan Fish Farm IBA.

Egyptian Vulture - *Neophron percnopterus*

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

Houbara Bustard - *Chlamydotis macqueenii*

Consultation with ecologists from the Emirate Centre for the Conservation of the Houbara (ECCH) at the Uzbekistan ECCH headquarters (to the east of Lake Tudakul) undertaken during the March field survey visit confirmed that houbara bustard occur Karnabchul Steppe IBA and adjacent areas. Birds associated with the ECCH reintroduction project are subject to a ringing and satellite tagging programme and individuals have been known to occasionally disperse from the re-introduction site to the wider Central Asia region, with the majority of birds residing within the IBA (ECCH ecologists *pers comm*). However, considering the small size of the habitat within the proposed project area, compared to the extensive areas of steppe which is ubiquitous throughout the region, the likelihood that this species is dependent on habitat within the proposed project area is considered to be negligible. Additionally, an elevated range of hills between the re-introduction site/IBA and the proposed project area has the potential to form a barrier to movement for this species.

Houbara bustard was not recorded within the AOI during the AECOM March 2020 ecological field survey visit. ECCH ecologists had commenced fieldwork to monitor the population of the breeding population within Karnabchul Steppe IBA in the first week of March (ECCH ecologists *pers comm*). Therefore, the timing of the AECOM ecological surveys in March 2020 are considered suitable in terms of detecting breeding populations of this species within the AOI.

6.5.6.2 Survey Results for the AECOM March 2020 Breeding and non-breeding residents (migratory) birds

There are several Eurasian migrants that winter in Uzbekistan or migrate through the country as part of the African-Eurasian flyway on route to neighbouring countries. Data has shown that there have been successive declines in populations of many Afro-Palaearctic migrant birds (BirdLife International, 2018). Other species may not breed in Uzbekistan but may migrate to other regions within Africa to breed.

The single threatened species of conservation concern was observed during the March 2020 field surveys: steppe eagle (*Aquila nipalensis*) [IUCN Endangered]. A total of eleven birds were observed migrating in a northerly direction over and immediately adjacent to the eastern boundary of the proposed Project site on 3rd March. However, it is considered likely that these birds were migrating on a broad front as the proposed project site is not located on a major migration route or migration bottle neck for migratory raptors and storks and therefore there is no reasonable likelihood that the site is significant for exceptionally high numbers of migratory or congregatory species.

Migratory species recorded during the field surveys, which may also breed within the proposed project area, are: desert wheatear (*Oenanthe deserti*) and isabelline wheatear (*Oenanthe isabellina*). These species are not of global conservation concern.

Figure 6-24. Steppe eagle migrating over site

Source: McAlister (2020). Site visit photos March 2020.

Figure 6-25. Desert wheatear on site

Source: McAlister (2020). Site visit photos March 2020.

6.5.6.3 Survey Results for Resident and Over-wintering Species

No resident or resident species of global conservation concern were observed during the March 2020 field survey. A single species which may be sensitive to collision with power-lines was recorded: black-bellied sandgrouse (*Pterocles orientalis*) [a pair were recorded utilising the proposed project site for resting/foraging]. Crested lark (*Galerida cristata*) was commonly recorded within the proposed project site.

Possible prey remnants of Saker falcon (*Falco cherrug*) [feral pigeon feathers] were noted during the field survey, however this species was not observed during the field survey visit.

6.5.7 Flora

The vegetation was found to be in a desiccated form in line with the weather conditions following the summer and many ephemeral species were in an early growth stage (seedling). The species that were identified during the March 2020 AECOM surveys are detailed in Section 5.5.3.

6.5.7.1 Terrestrial Mammals

No mammal species were observed during the March 2020 field visit, however several burrow complexes were noted. Small rodents are known to have burrow complexes and this was confirmed by the local ecologist during the field visit.

Yellow ground squirrel (*Spermophilus fulvus*) [IUCN Least Concern] was recorded adjacent to the proposed Project site, to the south of the M37 carriageway.

Goitered Gazelle - *Gazella* subgutturosa

Listed as Vulnerable by the IUCN, the species is threatened by illegal hunting and habitat loss (agricultural conversion and increasing domestic livestock numbers). Known to inhabit a range of desert and semi-desert habitats across Central Asia, it is listed as known in the desert area around Kagan Fish Farm, although no spatial scales are given (Birdlife International, 2019). No evidence was recorded during site surveys.

6.5.7.2 Bats

Bats species are nocturnal by nature and as the site surveys were conducted during the day no bats or evidence of their passing were observed.

The two farm complexes which are located immediately adjacent to the proposed Project site were assessed as having low potential for roosting bats during the March 2020 field surveys.

6.5.7.3 Reptiles

During the field survey, two reptile ecies were observed: Central Asian tortoise (*Testudo horsfieldii*) and sunwatcher toad-headed agama (*Phrynocephalus helioscopus*)

Central Asian tortoise

Listed as Vulnerable by the IUCN, the species is threatened by habitat loss (e.g. due to agricultural development) and long-term collection for the pet trade. This species is widely distributed in Uzbekistan and is widespread in semi-desert of the central Kyzylkum e.g. north-central Bukhara and southern Navoi (Showler, 2018).

Two individuals were observed during the field surveys; an adult and a juvenile which were emerging from winter hibernation burrows. This species is active between March and May and from late May onwards it hides in burrows. The field survey was undertaken in the early stage of the active season and therefore the population within the proposed Study Area may have been under-recorded. Suitable burrows for sheltering tortoises were noted within the Study Area.

The occurrence of Central Asian Tortoise does not trigger critical habitat in terms of IFC Performance Standard 6 (PS6); it is not listed as CR or EN on the IUCN Red List, nor is a restricted range species or endemic to Uzbekistan.

The species population in Navoi Region has not been determined for the purposes of this preliminary assessment, however further ecological field survey is programmed for late June 2020. Applying the 1% rule for national assessments in the UK, and with consideration of the relatively small size of the modified steppe habitat within the Study Area compared to the ubiquity of more natural steppe vegetation within the wider region, there is no reasonable likelihood that the Project area is of regional value for Central Asian Tortoise (i.e. supporting more than 1% of the Navoi Region population). Nevertheless, this species is listed as IUCN VU and populations are confirmed to be present within the Project area. Therefore, further primary and secondary data is required to accurately determine the ecological baseline conditions for this species, so that potential impacts can be assessed in accordance with good ESIA practice and applicable standards and guidelines for international finance. This will be presented within the final ESIA on completion of the June 2020 surveys.

Figure 6-26. Central Asian tortoise on site

Source: McAlister (2020). Site visit photos March 2020.

Sunwatcher toad-headed agama

Listed as Least Concern by the IUCN. At least two individuals were observed during the field surveys.

Figure 6-27. Sunwatcher toad-headed agama on site

Source: McAlister (2020). Site visit photos March 2020.

Other reptiles

Burrows which have the potential to support reptiles (for example lizards, snakes) were observed during the field visit, however the survey was not undertaken in the active season for many reptile species. Further survey and further information are proposed to be undertaken as part of the detailed ESIA study to confirm the status of reptiles within the Study Area.

Amphibians

The proposed Project site is unsuitable for amphibians. However, the wet drainage channels bordering the proposed Study Area e represent suitable aquatic habitat for amphibians however no observations of vocalising frog or toad species were noted.

6.6 Archaeology and Cultural Heritage

6.6.1 Approach to Assessment

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

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

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

IFC Performance Standard 8: Cultural Heritage (IFC 2012) aims to protect cultural heritage from the adverse impacts of project activities and support its preservation. Its scope includes:

- Tangible cultural heritage with archaeological, paleontological, historical, cultural, artistic, and religious values.
- Unique natural features or tangible objects that embody cultural values, such as sacred groves, sacred trees and rocks.
- Intangible forms of culture proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.
- Critical Cultural Heritage, internationally recognised or legally protected cultural heritage areas, including proposed World Heritage Sites. Heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes.

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

6.6.2 Desktop Study Methodology

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

Historical and modern mapping, aerial and satellite imagery, as well as topographic mapping and geological and soil mapping, was assessed during the preparation of the desktop study.

Available archaeological excavation and survey records were consulted, including regional atlases, academic studies, studies undertaken in association with environmental or development projects, relevant regional and period archaeological and landscape studies, dissertations and readily available historical evidence (see References).

Key data sources include papers on archaeology, anthropology and history in a range of journals, including proceedings of Soviet state archaeology and palaeontology institutes, History of Material Culture of Uzbekistan, Archaeological Research in Uzbekistan, Nature Institut Français d'Études sur l'Asie Centrale and key synthetic works such as the UNESCO History of Civilizations of Central Asia and Encyclopaedia Iranica.

6.6.3 Stakeholder Consultation

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

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

6.6.4 Cultural heritage baseline context

6.6.4.1 Site Location, Palaeontology and Palaeoclimate

Geology, topography and soils

The Project is located in Navoi Region, Karmana district. It is located in a relatively arid pastoral area verging on the Kyzylkum Desert, c.3.7km south of the Zarafshan River. The Aktau and Nuratau Mountains rise c. 25km to the north.

The eastern and western boundaries of the block of land in which the Site lies are formed by irrigation channels of the Zarafshan River. The fertile Zarafshan Valley, located between the Oxus (Amu Darya) and the Jaxartes (Syr Darya), has long been a key communication corridor across central Eurasia, through an arid landscape characterised by agricultural oases. A number of limestone springs (*kuturbulak*) are present to the south of the site, south of M37 road. At this stage it is not known if these are a viable source of water for the Project.

The Site is located immediately north of part of the Silk Roads trading route between Bukhara and Samarkand, which broadly followed the course of the M37 road.

Prior to the construction of large-scale irrigation canals in the 20th century, the sedentary population cultivated fertile land close to the river or oases at Bukhara, c.60km to the west and Samarkand, c.175km to the east. Historically, intermediate areas of desert and semi-desert, such as the Site, were used by pastoral nomads.

The geology of the Site, and the plains of the Zarafshan Valley, comprise deep deposits of Quaternary alluvial and wind-blown deposits, deluvial downhill flood outwash and proluvial mudflow accumulations. These were deposited in four main erosion and accumulation cycles – the Nanaian (Lower Quaternary), Tashkentian (Middle Quaternary), Golodnostepian (Upper Quaternary) and Syrdarinian (Holocene). These form a series of river terraces along the river valley, parts of which have been eroded out and exposed by channels of the Zarafshan River, and correspond to the Lower, Middle and Upper Pleistocene)[28].

Although there are Cretaceous outcrops in the Nurata Mountains and earlier potentially fossiliferous deposits in the immediate vicinity of Navoi, the Site has very limited palaeontological potential and this aspect has therefore been scoped out of assessment.

6.6.4.2 Previous archaeological investigations

An archaeological survey of the Zarafshan Valley was undertaken in the 1930s and 1940s, identifying ancient, early medieval and medieval sites[29]. Large-scale studies of the Neolithic and Bronze Age monuments in the lower reaches of the valley were carried out in the 1950s and 1960s[30]. These studies focussed on known areas of

[28] Kostenko, N. P. (1958). Geomorfologicheskij analiz rechnyh dolin gornyh stran (The geomorphological analysis of mountain river valleys). Bulleten Komissii po izucheniyu chetvertichnogo perioda 22: 73-90; Szymczak, K. 2000. Kuturbulak Revisited. A Middle Palaeolithic Site in Zeravshan River Valley, Uzbekistan. Swiatowit Supplement Series P: Prehistory and Middle Ages, II. Central Asia Prehistoric Studies, I. Institute of Archaeology, Warsaw University.
[29] Yakubovsky, A. Yu. (1950) Itogi rabot Tadžikskoj arheologičeskoj èkspedicii za 1948-1950 gg (Results of the work of the Tajik archaeological expedition for 1948-1950). Materials and Studies in the Archaeology of the USSR. No. 15, 9-20; Yakubovsky, A. Yu. (ed.) (1950) Trudy' Sogdiysko-Tadjikskoy arheologicheskoy e`kspedicii (Proceedings of the Sogd-Tajik Archaeological expedition). Vol. 1. 1946–1947. Moscow; Leningrad: Academy of Sciences of the USSR.
[30] Gulyamov Ja.G., Islamov U., Askarov, A.A. (1966) Pervobytnaja kul'tura i voznik- novenie orošaemogo zemledelija v nizov'jah Zarafšana (The primitive culture and the emergence of irrigated agriculture in the lower reaches of Zarafshan). Tashkent; Askarov, A. 1962. Pamjatniki

archaeological potential and upstanding monuments. Investigations were led by the Palaeontological Institute and the Institute of History of Material Culture (later the Institute of Archaeology) of the USSR Academy of Sciences (Central Asia and the Caucasus Section, Leningrad; Uzbek Branch) and the Institute of History, Archaeology & Ethnography of the Academy of Science of the Uzbek Soviet Socialist Republic.

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

6.6.4.3 Archaeological and Historical Background

Palaeolithic (100,000 BP to c. 20,000 BP)

Past climates may have influenced the location and extent of past human occupation. The Last Interglaciation in Central Asia (130-75,000 BP (Before Present)) was followed by the First Glacial Maximum (74-60,000 BP), then a warm early phase of the OIS 3 interstadial (59-44,000 BP), finishing with the local Last Glacial Maximum in Central Asia (43-28,000 BP).[31]. Studies suggest that during late Pleistocene and Holocene glacial-interglacial transitions in Central Asia, hominin populations did not abandon the area, but may have aggregated in areas with the least seasonal temperature variations, or found other suitable niches such as caves[32]. This could indicate that the climate was not as hostile as traditionally considered, that populations adapted rapidly to a changing climate, or that in some cases, populations – of both Neanderthals and anatomically modern humans – sought refuge in the milder deserts and plains of the continental steppe during glaciations, perhaps resulting in hybridisation[33].

There are no known archaeological remains of this period in the vicinity of the Site.

Mesolithic (15,000-6000 BCE) and Neolithic (6000-4000 BCE)

During the late Pleistocene, the climate was cold and arid, which is assumed to have constrained human populations to lowland areas. Between c.8000 and 7000 BCE, the climate became milder and more humid[34]. Stray finds of stone tools have been found across the region. Mesolithic and Neolithic tools, animal bone, hearths and ceramics have been recovered from two sites in the foothill plain at Sazagan (Samarkand District), between 900m and 1000m above sea level, dating to c. 6 to 8 thousand years ago[35]. The Neolithic period is characterised by the development of arable agriculture and the domestication of animals, the development of new tools such as sickle blades and polished axes and the extensive use of ceramics. During the Neolithic, populations seem to have focussed on the foothills, around mountain rivers and rock outcrops with springs and raw materials for making stone tools. However, investigations at sites such as Ayak-Agitma in the Kyzylkum Desert[36] indicate once-extensive settlement, foraging and farming in areas which are now arid desert.

There are no known archaeological remains of this period in the vicinity of the Site.

Eneolithic/Chalcolithic (4000-3000 BCE) and Bronze Age (3000-900 BCE)

The Bronze Age is characterised by increasing aridisation of the climate, decreasing wild resources, the development of livestock breeding[37]. The Indo-Iranian Andronovo cultural complex flourished between c. 2000

andronovskoj kul'tury v nizov'jah Zeravšana. (Monuments of Andronovo culture in the lower reaches of Zeravshan). History of material culture of Uzbekistan (IMKU, IMKUz), Vol. 3. Fan, Tashkent/ Samarkand

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

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

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

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

[35] Dzhurakulov M.D. & Kholmatov N.U. (1991) Mezolit i neolit Srednego Zarafšana (Sazaganskaja kul'tura). (Mesolithic and Neolithic Middle Zarafshan (Sazagan culture). Tashkent.

[36] Szymczak K., Gretchkina T. Ayakagytma (1995) a new Early Neolithic (Kelteminarian) site in SE Kyzyl-kum Desert, Neo-Lithics: Newsletter of Southwest Asian Lithics Research: 16-21.

[37] Askarov A. (1962) Pamyatniki andronovskoy kul'tury v nizov'yakh Zeravsha-na. (Monuments of Andronovo culture in the lower reaches of Zeravshan). IMKU. V'shch.Z; Guljamov, J.G., Islomov U., Askarov A. (1966) Pervobytnaja kul'tura i vozniknovenie orošaemogo zemledelija v nizov'jah Zeravšana (Primitive culture and the emergence of irrigated agriculture in the lower reaches of Zeravshan). Tashkent

and 900 BCE. The local Alakul sub-culture developed between the Amu Darya and Syr Darya Rivers in 1800–1500 BCE. The economy was based on herding horses, sheep and cattle, with seasonal camps and islands of agriculture; agricultural settlements were concentrated along small rivers and around lakes and oases. Technological developments include horse-drawn chariots, the spread of axes and spears, and burial mounds. Pit graves were marked by square or round mounds, low earthen embankments and sometimes had stone kerbs (kurgans). Burials were accompanied by food, pottery, flint arrowheads, bronze tools and weapons, copper and paste beads, and gold and copper earrings.

From the Bronze Age to the medieval period, rock outcrops, such as those at the Sarmishsay Natural and Archaeological Museum-Reserve (State Register, Archaeological monuments Nos. 87-89, Navbakhor District: World Heritage Tentative List Ref. 5307), were decorated with 'picture galleries' depicting images of people, animals, hunting and grazing[38].

There are no known archaeological remains of this period in the vicinity of the Site.

Sogdian City States (c. 700 BCE – 4th century CE)

In the 7th to 6th century BCE, the Zarafshan valley formed part of the Bactrian Kingdom, which traded gold and bronze objects with China, Persia and Europe, and practiced irrigated agriculture. By 700 BCE, a series of Sogdian city states had developed along the Zarafshan Valley, eventually merging to become Bukhara[39]. Bukhara was captured and annexed by the Persian Achaemenid Empire in the in 546–539 BCE, following the conquests of Central Asia by Cyrus the Great. Persian control weakened c. 400 BCE and Sogdiana became independent.

Known cultural heritage assets in the vicinity of the Site

A series of nomadic burial mounds were excavated in the vicinity of the village of Hazara, located c. 5km north-northeast of the Project area, in the 1950s.[40] These have been variously attributed to Sogdian pastoralists, Sarmatian tribes attacking Greco-Bactria, or Yuezhi passing through Sogdia.[41]

The Navoi Region State Register lists a series of settlement sites in the area of indeterminate date, including:

- Kitirbulok Tepe (Round Hill) at Duldul village (Archaeological Monument No. 76);
- Dormontepa, at Bobodogo/ Durmenanta rural area (Archaeological Monument No. 135); and
- Diggaron, at Katagan village (Archaeological Monument No. 20).

Hephthalite Empire and Turkic Kaganate (5th to 7th century CE)

Bukhara and Samarkand went on to became part of the multinational Hephthalite Empire, led by the trading city of Paikend, c. 40 km to the west of Bukhara. The Hephthalites expanded in the later 5th century CE, trading with Iran, Byzantium, India, and China. In 563-567 the Hephthalites were defeated by semi-nomadic Turkic tribes of Altai. Allied with Byzantium and exacting tribute from China, the Western Turkic Kaganate flourished in the 7th century CE. The caravan route between Merv, Bukhara, Samarkand and Chach (Tashkent) prospered, trading silk, metalwork, jewellery and spices with India, China and Persia.

Arab conquest and Khanate of Transoxiana (Māwarāʿ al-Nahr/ Maveraunnakhr) (8th to 16th century)

The Muslim conquest of Sogdiana began in 674, establishing the rule of the Umayyad Caliphate in Maveraunnakhr – the land on the right bank of Amu Darya River. Bukhara was captured in 709 and an Arab garrison was installed to secure against rebellion. It became the capital of the Iranian Samanid Dynasty (819–1005), and was an Islamic cultural centre for art, architecture, literature, and thought. Sogdiana was incorporated into the Uighur Khaganate (744–840), selling Chinese silk on to the west. The Uighurs adopted the Sogdians' writing system and religious

[38] Tashkenbaev N.Kh. (1966) Naskal'nyye izobrazheniya Korongursaya i Sarmysha. (Rock Images in Korongursay and Sarmysh. Istoria materialnoi kultury Uzbekistana 8: 36–39; Khujanazarov, M. (2001) Petroglyphs of Uzbekistan. In Tashbaeva, K., Khujanazarov, M., Ranov, V., Samashev, Z. (eds) Petroglyphs of Central Asia. International Institute for Central Asian Studies, Bishkek: 80–121.
[39] De la Vaissière, E. (2005) Sogdian Traders: a History. Brill, Leiden; Boston.
[40] Obelchenko, O.V. (1956) 'Kuyu-Mazarsky mogil'nik' (The Necropolis of Kuyu-Mazar) Trudy IIA AN Uz. SSR VIII, Tashkent: 205-227; Obelchenko, O.V. (1963) 'Kurgany okolo sel. Khazara' (The Kurgans Near the Village of Khazara) IMKUz, Tashkent: 57-65.
[41] Benjamin, C. (2007) The migration of the Yuezhi through Sogdia. The Yuezhi. Origin, Migration and the Conquest of Northern Bactria. Brepols, Turnhout: 147-157

faiths, such as Zoroastrianism, Manichaeism, Buddhism, and Christianity. By the 10th century the largely Zoroastrian Sogdians had mostly converted to Islam.

Known cultural heritage assets in the vicinity of the Site

The course of the Silk Road connecting Bukhara and Samarkand is located immediately south of the Project, broadly following the course of the M37 highway from Navoi to Bukhara. The **Silk Roads Sites in Uzbekistan** (Ref.: 5500) are on Uzbekistan's Tentative World Heritage List.

The Navoi Region State Register lists a series of settlement sites in the area, including the **6th to 11th century settlement of Hazora/Khazara at Toshrabot** (Archaeological Monument No. 33) and the **Ganchtepa (Toshrabot-2) early medieval settlement at Saribosh village** (Archaeological Monument No. 134). Hazora was a centre of pottery production during the middle ages. The Panjakent Division of the Sogdian-Tajik Archaeological Expedition (1946) identified the remains of an ancient settlement, the walls of the city citadel and several small ribats (fortified inns); excavations recovered extensive pottery assemblages, including a ritual vessel from a Zoroastrian burial.

The **11th century Deggaron Mosque** (Navoi Region State Register Architectural Monument No. 44) is one of the one of the earliest preserved Islamic religious buildings, which may have been converted into a mosque from a Zoroastrian temple. The **Deggaron Complex** (State Register Architectural Monument No. 45) includes the *khanaka* (monastery/inn) and mausoleum of Shaykh Malono Orif Deggaroni (1313–1376) which has recently been restored. Deggaroni was a mentor of Bohauddin Naqshband (1318–1389), the founder of what would become one of the largest Sufi orders. The complex is a pilgrimage site and includes a museum, garden, wells, a cooking and dining area and a chillahona (prayer area).

Figure 6-28: Deggaron Mosque

Source: McAlister (2020). Site visit photos March 2020.

The **Sardoba Malik (Royal Well)**, an underground well under a domed structure, is located on the south side of the M37 highway immediately south of the caravanserai (State Registered Archaeological Monument, Navoi

Region No. 42). It was built in the 11th to 12th century, supplied by the underground Narpai canal and irrigation channels from the Zaravshan River.

Figure 6-29: Sardoba Malik

Source: McAlister (2020). Site visit photos March 2020.

The **Rabati Malik (Royal Fortress) Caravanserai**, a State Registered Architectural Monument (Navoi Region No. 43) and Tentative WHS List site (Ref.: 5308), is located c. 12 km east of the Project, north of the M37 highway. Built in the late 11th century, and reconstructed in the 12th century, it was a palatial residence and headquarters of the Karakhanids. Following the Mongol invasions in the 13th century, it gradually became a roadside caravanserai on the main road from Samarkand to Bukhara. The caravanserai remained in use until the 18th century. The main facade was largely demolished in the 1940s and 1950s. With the exception of the 18m high portal, the caravanserai flanking walls were demolished by the earthquake of 1968. Archaeological investigations were carried out in the 1970s and 1997-2001; clarifying its layout and recording the caravanserai's cemetery. This is one of the largest caravanserais in Central Asia. Its building techniques are analogous with those noted in the contemporary Sulton-Saodat religious complex in Termez (Surxondaryo Region), the Samanid Mausoleum and Namazgoh Mosque in Bukhara (Bukhara Region) and buildings in the Karakhanid capital, Uzgen (Osh Region, Kyrgyzstan).

Figure 6-30: Rabati Malik Caravanserai entrance

Source: McAlister (2020). Site visit photos March 2020.

Figure 6-31: Rabati Malik Caravanserai inside

Source: McAlister (2020). Site visit photos March 2020.

Figure 6-32: Computer Generated Image of Rabati Malik Caravanserai

Emirate of Bukhara (16th to 19th century)

The Shaybanids (1500–1601) made Bukhara the capital of their state, the Khanate of Bukhara, from the mid-16th century. They were succeeded by the Astrakhanid dynasty (1602–1747) and the Uzbek Manghit dynasty (1753–1920). The area declined in prosperity, partly due to the reduction in caravan trade along the Silk Roads resulting from the rise of maritime trade routes.”.

In the late 18th century, irrigation works began to be redeveloped in the Zarafshan valley during the reign of Manghit Emir Shah Murad (1785–1800), and continued under his son, Emir Haider (1800–1826). In the early 19th century, cattle breeding was common; Uzbek nomads spent their summers in yurts and their winters in cities and villages. The transition to settled agriculture was slow.

The Emirate, established in 1785, became a vassal protectorate of the Russian Empire in 1868, but the rule of the khans persisted until the Russian Revolution in 1917.

Known cultural heritage assets in the vicinity of the Site

In the 17th century, a fortress was built in the village of Deggaron (Hazora). Parts of the remains of the fortress wall survive.

Figure 6-33: Remains of Fortress at Hazora

Source: McAlister (2020). Site visit photos March 2020.

Figure 6-34: OHL Tower built on the remains of the fortress wall

Source: McAlister (2020). Site visit photos March 2020.

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

In 1920, the Red Army captured Bukhara and extinguished the khanate of Bukhara. The Uzbek S.S.R. (now Uzbekistan) was created in 1924. Traditional pastoral nomadism was virtually abolished by Soviet forced collectivisation in the 1920s and 1930s. Irrigation projects were undertaken along the Zarafshan Valley to colonise the steppe and develop intensive cotton monoculture. Navoi City was founded in 1958 adjacent to the historic Silk Road settlement of Karman. Navoi was a gold and uranium mining centre, with a smelting plant in the area of Karman village. Uzbekistan declared independence from the U.S.S.R. in 1991.

The site location is indicated in red. Overhead power lines cross the south of the site. It appears to show a vineyard at Uzumzor [Узумзор] to the east; the place name means 'vineyard' in Uzbek.

Known cultural heritage assets in the vicinity of the Site

6.6.4.4 Tangible Cultural Heritage

Archaeological Sites

The Project site has not been subject to archaeological field survey. The wider area has not been subject to substantial or recent archaeological field research.

A review of the known archaeology and history of the wider Project area indicates that there is low potential for the presence of Palaeolithic, Mesolithic and Neolithic material. Throughout the later prehistoric, antique and medieval periods, it is likely that this semi-arid desert area was populated by mobile herders. There is some potential for the presence of stray finds (casual losses), travellers' campsites and for burial mounds (*kurgan*).

Any terrestrial archaeological remains within the Project Area are likely to comprise:

- In situ surface scatters or features identified on bare ground.

- Surface scatters identified in areas of disturbed ground or in up-cast spoil from groundworks.
- Buried features, which may have moderate depth and complexity.

The visibility of sites may be hampered by burial under wind-blown sands.

Natural Features and Tangible Objects with Cultural Values

Unique natural features or tangible objects that embody cultural values, such as sacred plants, rocks and watercourses can be significant aspects of cultural landscapes. Interviews with local communities do not indicate the presence of any natural features and tangible objects with cultural values.

6.6.4.5 Intangible Cultural Heritage

Intangible cultural heritage is defined as the practices, representations, expressions, as well as the knowledge and skills (including instruments, objects, artefacts, cultural spaces), that communities, groups and, in some cases, individuals recognised as part of their cultural heritage. It is sometimes called living cultural heritage and includes oral traditions and expressions, including language; performing arts; social practices, rituals and festive events; knowledge and practices concerning nature and the universe; and traditional craftsmanship (UNESCO, 2003).

UNESCO Representative List of Intangible Cultural Heritage

Uzbekistan's entries on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity comprise:

- Khorazm dance, Lazgi (2019). The movements of the dance reflect the sounds and movements of nature, flora and fauna. It is performed during national holidays and folk festivities and during community and family events.
- Margilan Crafts Development Centre, safeguarding of the atlas and adras making traditional silk textile production technologies (Register of Good Safeguarding Practices; 2017).
- NavUzbekistan New Year, March 21 (2016). A variety of rituals, ceremonies and other cultural events take place for a period of about two weeks.
- Palov culture and tradition (2016). Palov is a traditional dish of rice, meat, spices and vegetables.
- Askiya, the art of wit (2014). Askiya is often performed in folk celebrations, festivities, family-related rituals and get-togethers.
- Katta Ashula (2009). A type of traditional song that forms part of the identity of various peoples of the Ferghana Valley.
- Cultural space of Boysun District (2008). The Boysun District located in south-eastern Uzbekistan on the route from Asia Minor to India, is one of the oldest inhabited areas of Central Asia. With the diminishing importance of the Silk Road and the political changes in Central Asia, the region became quite isolated, which favoured the preservation of ancient traditions that show traces of several religions, including shamanistic beliefs, Zoroastrianism, Buddhism and Islam.
- Shashmaqom music (2008). The classical music tradition of Shashmaqom has evolved in the urban centres of present-day Tajikistan and Uzbekistan, fusing vocal and instrumental music, melodic and rhythmic idioms and poetry. Its origins date back to the pre-Islamic era.

It is not assessed that the continuation and transmission of any entries on the Representative List would be impacted by the Project.

Local intangible cultural heritage activities

Local crafts related to intangible heritage include silk production and weaving, rug and carpet-making and motifs; ceramics and varnished miniatures; wood-carving; metal chasing and embossing; silk and gold embroidery and tapestry; the Uzbek language; and culinary traditions.

Religious practices in the locality comprise Muslim 88% (mostly Sunni), Eastern Orthodox 9%, other 3%. Uzbekistan has experienced a resurgence in religious practice since the 1980s, with increased activities of religious schools, neighbourhood mosques and religious orders. The surrounding area has a number of Islamic

centres with their *maktabs* (primary schools) and *madrasahs* (seminaries) organized and supported by Muslim religious educators and their followers.

The town of Hazora, c.5km northeast of the Project, is the focus of pilgrimages to the Mavlono Orif Deggaroni Complex. The Mavlono Orif Deggaroni Mosque and Complex, are State Registered architectural monuments (Navoi Region State Register Architectural Monument No. 44 & 52), but no particular intangible heritage elements are designated or registered. The Mavlono Orif Deggaroni complex is associated with the Naqshbandi, a major Sunni spiritual order of Sufism, an active movement of international significance.

There are no associations with particular innovations, technical or scientific development.

6.6.4.6 Critical Cultural Heritage

Critical Cultural Heritage is defined as internationally recognized or legally protected cultural heritage areas, including proposed World Heritage Sites, or the heritage of communities who use, or have used within living memory the cultural heritage (IFC, 2012).

The Project site itself does not contain any internationally recognized or legally protected cultural heritage areas. Immediately south of the Project, the M37 road broadly follows the course of the Silk Roads, a Tentative List World Heritage Site (Ref. 5500). About 5km northeast of the Project site is the village of Hazora, site of the Malono Orif Deggaroni Mosque and Complex (Nos. 44 & 52), associated with the mentor of the founder of the Sufi Naqshband order and the site of pilgrimages.

Community Use of Cultural Heritage

A cemetery is located south of the Mavlono Orif Deggaroni Complex at Hazora (State Register Architectural Monument No. 52) [4.60km to NNE of Project: 40° 9'3.34"N 65° 0'44.04"E]. It is not clear whether the cemetery is included in this designation, and/or is subject to separate protection under statute law, religious law or customary practice.

Potential Significance of Archaeological Remains

No internationally recognised or legally protected cultural heritage areas have been identified within the Study Area. The Study Area has moderate potential to contain significant, stratigraphically intact archaeological remains; any remains present may have been impacts by erosion caused by physical, climatic and chemical weathering. It is anticipated that any superficial or buried archaeological sites within the Project area are likely to be classed according to IFC criteria as 'replicable cultural heritage' (IFC, 2012), and can be mitigated by appropriate archaeological investigation, recording and dissemination.

Internationally Recognised Cultural Heritage Areas

World Heritage properties

Uzbekistan has four cultural sites inscribed on the World Heritage List. The nearest is the **Historic Centre of Bukhara** (inscription date: 1993; ref: 602bis). Bukhara, which is situated on the Silk Route, is more than 2,000 years old. It is the most complete example of a medieval city in Central Asia, with an urban fabric that has remained largely intact. Monuments of particular interest include the famous tomb of Ismail Samani, a masterpiece of 10th-century Muslim architecture, and a large number of 17th-century madrasas.

Bukhara is located c. 60km southwest of the Site. Given its distance from the Site, the Project will not impact upon it.

Tentative List World Heritage Sites

A Tentative List is an inventory of those properties which each State Party intends to consider for nomination to the World Heritage List. There is one cultural Tentative List World Heritage Site located within or in the vicinity of the Study Area:

- **Silk Roads Sites in Uzbekistan** (Ref. 5500) facilitated trade in silk and materials such as precious metals and stones, ceramics, perfumes, ornamental woods, and spices in return for cotton and wool textiles, glass, wine, amber, carpets and horses. This trade was sustained by a system of caravanserais, commercial settlements, trade cities and forts, spreading ideas, scientific and technological developments. Components in the vicinity of the Project include the Rabati Malik caravanserai, the Vobkent Minaret, and sites in

Karmana including the Mir-Sayid Bakhrom Mausoleum and Qosim Sheikh complex. The course of the M37 road immediately south of the Site, between Bukhara and Samarkand, follows the course of the Silk Roads.

Table 6-6 Internationally Recognised Cultural Heritage Areas in the vicinity of the Project

International designation	UNESCO Reference No.	State Register	State Register No.	Description	Distance from Site	Latitude (N) DMS	Longitude (E) DMS
World Heritage State Party Tentative List	TL Ref. 5500	Architectural/ Archaeological monuments	Var	Silk Roads Sites in Uzbekistan	0.2km to S	In vicinity of Project, broadly aligned with route of M37 road	
World Heritage State Party Tentative List	TL Ref. 5308	Architectural Monument	No. 43	Caravanserai Malikrabot. Date: 11th century. «Sardoba» MFY. Karmana District.	12.35km to E	40° 7' 21.86''N	65° 8' 53.75''E
		Architectural Monument	No. 42	Sardoba Malikrabot (Well). Date: 11th century. «Sardoba» MFY. Karmana District.	12.40km to E	40° 7' 16.54''N	65° 8' 48.95''E
		Archaeological monuments	No. 30	Raboti-Maliktepa (Bekmehmontepa). Date: 6th – 12th century. Sardoba. Karmana District.	c.12km to E	Uncertain U	

Legally Protected Cultural Heritage Areas

State Register sites located in the vicinity of the Study Area are presented in Table 6-7. None of these protected areas are located within the Project area, and the Project would not impact upon them.

Table 6-7 Extract from the State Register sites on the National List of Immovable Property of the Intangible Cultural Heritage – Navoi Region, Karmana District & Kyzyltepa District

State No.	Name of the object	Date	Address	Right to real estate	Distance from Site	Latitude (N) DMS	Longitude (E) DMS
Archaeological monuments							
20.	Diggaron	Indeterminate	Hazora microdistrict, Katagan village	State property. Navoi Regional Cultural Heritage Department based on the right of operative management.	5.15km to NNE	40° 9'19.61"N	65° 0'41.21"E
30.	Raboti-Maliktepa (Bekmehmontepa)	6th – 12th Century	Sardoba	State Property. Navoi Regional Cultural Heritage Department based on the right of operative management.	c.12km to E	U	U
33.	Hazora	6th – 11th centuries	“Hazora” (Toshrabot) MFY, Livestock village	State property. Navoi Regional Cultural Heritage Department based on the right of operative management	U	U	U
76.	Kitirbulok Tepe (Round Hill)	Not specified	“Dul dul” MFY, Duldul village	State property. Navoi Regional Cultural Heritage Department	10.5km to NE	40°10'39.50" N	65° 4'41.55"E

State No.	Name of the object	Date	Address	Right to real estate	Distance from Site	Latitude (N) DMS	Longitude (E) DMS
				based on the right of operative management			
134.	Ganchtepa (Toshrabot-2)	Early Middle Ages	Hasancha MFY, Saribosh village	State property. Navoi Regional Cultural Heritage Department based on the right of operative management	7.70km to NW	40° 9'1.29"N	64°53'30.82" E
135.	Dormontepa	Not specified	"Bobodogo" MF, Durmenanta rural area	State property. Navoi Regional Cultural Heritage Department based on the right of operative management.	7.05km to N	40°11'2.55" N	64°58'48.41" E
Architectural monuments							
42.	Sardoba Malikrabot (Well)	11th century	"Sardoba" MFY	State property. Navoi Regional Cultural Heritage Department based on the right of operative management.	12.40km to E	40° 7'16.54"N	65° 8'48.95"E
43.	Caravanserai Malikrabot	11th century	"Sardoba" MFY	State property. Navoi Regional Cultural Heritage Department based on the right of operative management.	12.35km to E	40° 7'21.86"N	65° 8'53.75"E
44.	Mavlono Orif Deggaroni Mosque	11th century	"Hazora" MF, Katagon rural settlement	State property. Navoi Regional Cultural Heritage Department based on the right of operative management. The foundation is attached to the charitable public foundation on a free use agreement.	5.10km to NNE	40° 9'18.52"N	65° 0'39.05"E
52.	Mavlono Orif Deggaroni Complex	11th century	"Hazora" MF, Katagon rural settlement	State property. Navoi Regional Cultural Heritage Department based on the right of operative management. The foundation is attached to the charitable public foundation on a free use agreement.	4.9km to NNE	40° 9'13.55"N	65° 0'44.87"E

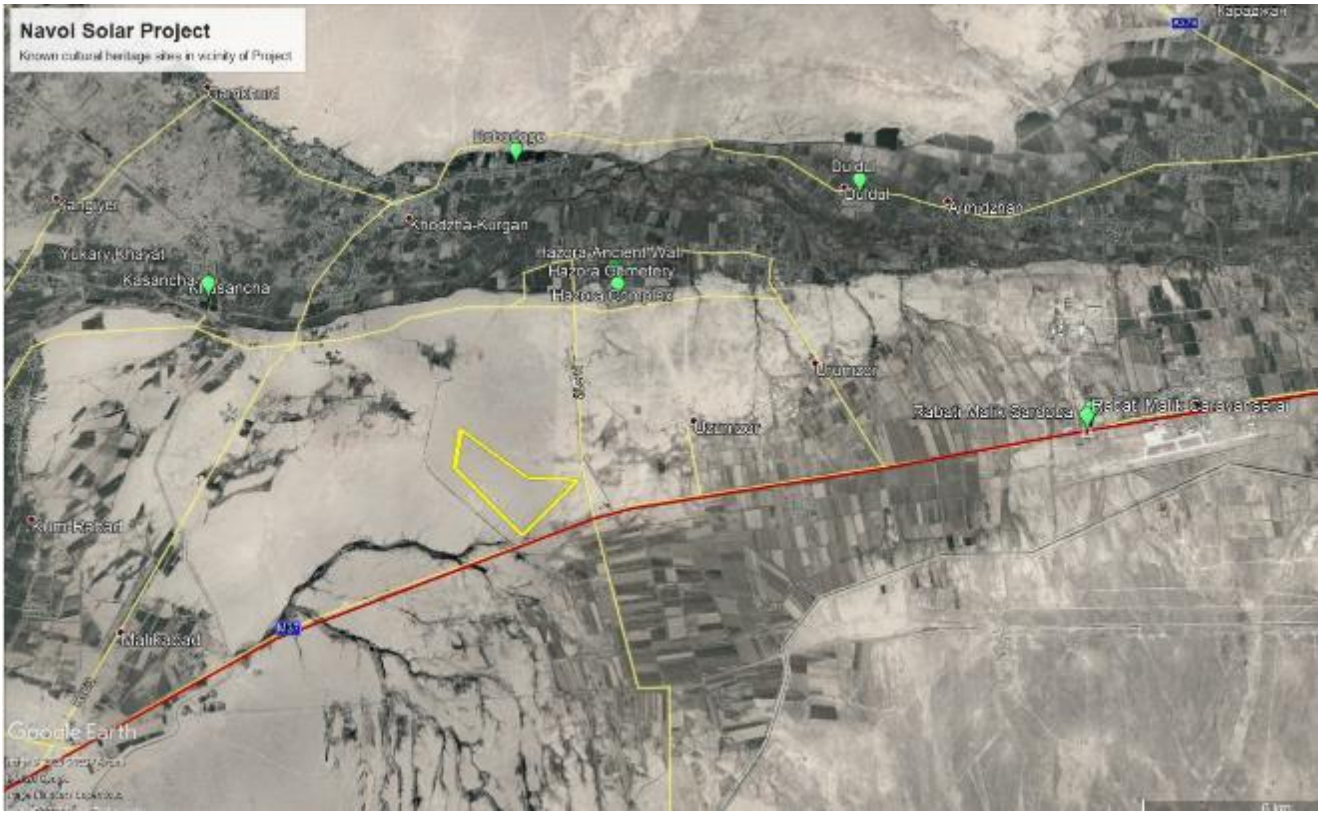

Figure 6-35 Location of known cultural heritage sites in the vicinity of the Project

6.7 Socio-economic Conditions

6.7.1 Introduction

The proposed project site is located in the Navoi Region, the largest of Uzbekistan's 12 regions (111.09 km2), situated in the central north/northwest of the country. The Project is located approximately 30 km west from the town of Navoi (the regional) administrative capital in the Navoi District (also called Karmana). Navoi District is one of the eight districts forming the Navoi Region. It lies south of the region and is directly bordering the districts of Kyzyltepa, Navbakhor, Kanimekh, Khatyrchi, and Nurata. Navoi District is also adjacent to the region of Samarkand and within it, to Pakhtachi District.

The closest residential areas identified around the Project are the village of Uzumzor (2.6 km east from the site boundary), and a small residential cluster (2.2 km south from the site boundary). The area is characterised by desert conditions, with irrigated land and the Zarafshan river located approximately 4.3 km north from the site.

6.7.2 Economy

Uzbekistan is a lower middle-income country, defined by the World Bank as economies with a GNI per capita between $1,026 and $3,995 USD[42]. The Uzbekistani Som (UZS) is the currency of Uzbekistan – as of 5 March 2020, $1 USD was equal to 9,513.84 UZS[43].

According to the IMF, in 2019, the Gross Domestic Product (GDP) of Uzbekistan was at $60.490 billion USD[44]. Navoi Region occupies the fourth place of contribution to the formation of the GDP of Uzbekistan, with a share of 7.2% – just below the neighbouring Samarkand Region (7.3%). Navoi Region has the fourth largest GDP of Uzbekistan (36,685.2 billion UZS) and the largest GDP per capita, at 37,119.5 thousand UZS.

[42] World Bank (2019). World Bank Country and Lending Groups – World Bank Data Help Desk. [online] Worldbank.org. Available at: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups [Accessed 5 Mar. 2020].
[43] Central Bank of the Republic of Uzbekistan (n.d.). Ўзбекистон Республикаси Марказий банки — Бош саҳифа. [online] www.cbu.uz. Available at: http://www.cbu.uz/uzc/ [Accessed 5 Mar. 2020].
[44] International Monetary Fund (2019). World Economic Outlook Database October 2019. [online] Imf.org. Available at: https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx [Accessed 5 Mar. 2020].

The national GDP composition by sector of origin is split between agriculture (28.1%), industry (36.4%) and services (35.5%). Comparing the changes in the structure of the economy between 2017 and 2019 shows a 30% increase in the share of the industrial sector and a decrease of 28.1% in the share of agricultural sector. Navoi Region is characterised by its large industrial sector relative to other regions and the country. In 2019, Navoi Region held the largest share for industry (66.8%) within the sectoral structure of the regional GDP – or GRP. Correspondingly, it also held the smallest share recorded for agriculture (16.7%) and services (12%). Navoi Region is mportant in terms of industrial contribution to the economy of the country, estimating it at 10% of the total industrial production.

The soil of Navoi Region is rich in precious metal and, as such, is home to important mining, chemical and energy industries. Navoi International Airport is also the largest air cargo terminal in Central Asia. Noteworthy, the entire Navoi Region was designated as a free economic zone (FEZ) following the enactment of a Presidential Decree. The main goals of this decision are to attract direct investment to create innovative, high-tech, export-oriented and import-substituting enterprises producing high value-added products, as well as to develop transport and other infrastructure of the region to turn it into a major logistics centre. In order to finance relevant investment projects, the Ministry of Investments and Foreign Trade together with commercial banks have been instructed to develop proposals for attracting credit lines from international financial institutions and foreign export credit agencies.[45]

There is little data available at the Navoi/Karmana District level. According to the Navoi Region website, large industrial enterprises based in the district include CJSC Navoi TPP (electricity and isotope energy generation) and spare parts, THAEL POLYMER Synthesis JV (polymer products), JV "Kar-Rig trans" (transport services), JV "Gypsum Products" (production of building materials). Data related to agricultural production is available at the district level. Table 9 below shows agricultural production in tons, units or heads for Navoi Region and Navoi/Karmana District, as well as the contribution of the district to the total regional production. A large proportion of eggs, poultry and vegetables produced regionally originate from the district.

Table 6-8: Agricultural products in Navoi Region and Navoi/Karmana District, 2018[46]

Products	Navoi Region	Karmana District	% District in Region
Tons			
Meat (in live weight)	159,674	17,964	11.3
Milk	477,797	66,051	13.8
Honey	1,008	103	10.2
Wool	4,079	303	7.4
Cocoon raw material	801	75	9.4
Cotton	83,025	14,808	17.8
Grain	214,433	26,988	12.6
Potatoes	76,851	8,619	11.2
Vegetables	274,645	54,214	19.7
Melons	88,119	9,510	10.8
Fruits	100,417	10,399	10.4
Grapes	76,933	4,486	5.8
Units			
Eggs (per thousand)	276,584	74,514	26.9
Leather skin	261,474	7,824	3.0

[45] Dentons (2019). Uzbekistan has declared its largest region a free economic zone. [online] www.dentons.com. Available at: https://www.dentons.com/en/insights/alerts/2019/may/28/uzbekistan-has-declared-its-largest-region-a-free-economic-zone [Accessed 5 Mar. 2020].
[46] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Diagramma va grafiklar. [online] stat.uz. Available at: https://stat.uz/uz/index.php?option=com_content&view=article&id=5742&catid=2&lang=uk-UA [Accessed 5 Mar. 2020].

Products	Navoi Region	Karmana District	% District in Region
Head			
Cattle	484,036	59,498	12.3
including: cows	199,549	22,391	11.2
Sheep and goats	2,060,239	116,996	5.7
Horses	17,878	407	2.3
Poultry of all kinds	2,595,191	706,295	27.2

During the meeting organised with local institutional stakeholders, the representative from the local Council (Uzumzor) reported that the local economy, regarding Uzumzor as well as the residential cluster at the south, relies mostly on agricultural activities, in particular cotton and wheat. Although evidence shows that the region is characterised by its industrial sector, preliminary sites visits have identified the agricultural nature of the local economy around Uzumzor. Further research and site visits will confirm this information and will need to further investigate the weight of the industrial sector and its composition.

6.7.3 Population

According to stat.uz[47], there are 34,022,853 inhabitants as of 28 February 2020. Figure 6-36 below provides information regarding the age distribution of the population of Uzbekistan. The majority of the population (64%) is aged below 35 years-old while those over 35 account for 36%. The 0-4 age group is the largest among all age groups, which may indicate a high birth rate. In terms of gender distribution, the country has slightly more males (50.2%) than females (49.8%).

[47] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Permanent population number. [online] stat.uz. Available at: https://stat.uz/en/open-data/2-uncategorised/7163-o-zbekiston-aholisi-en [Accessed 5 Mar. 2020].

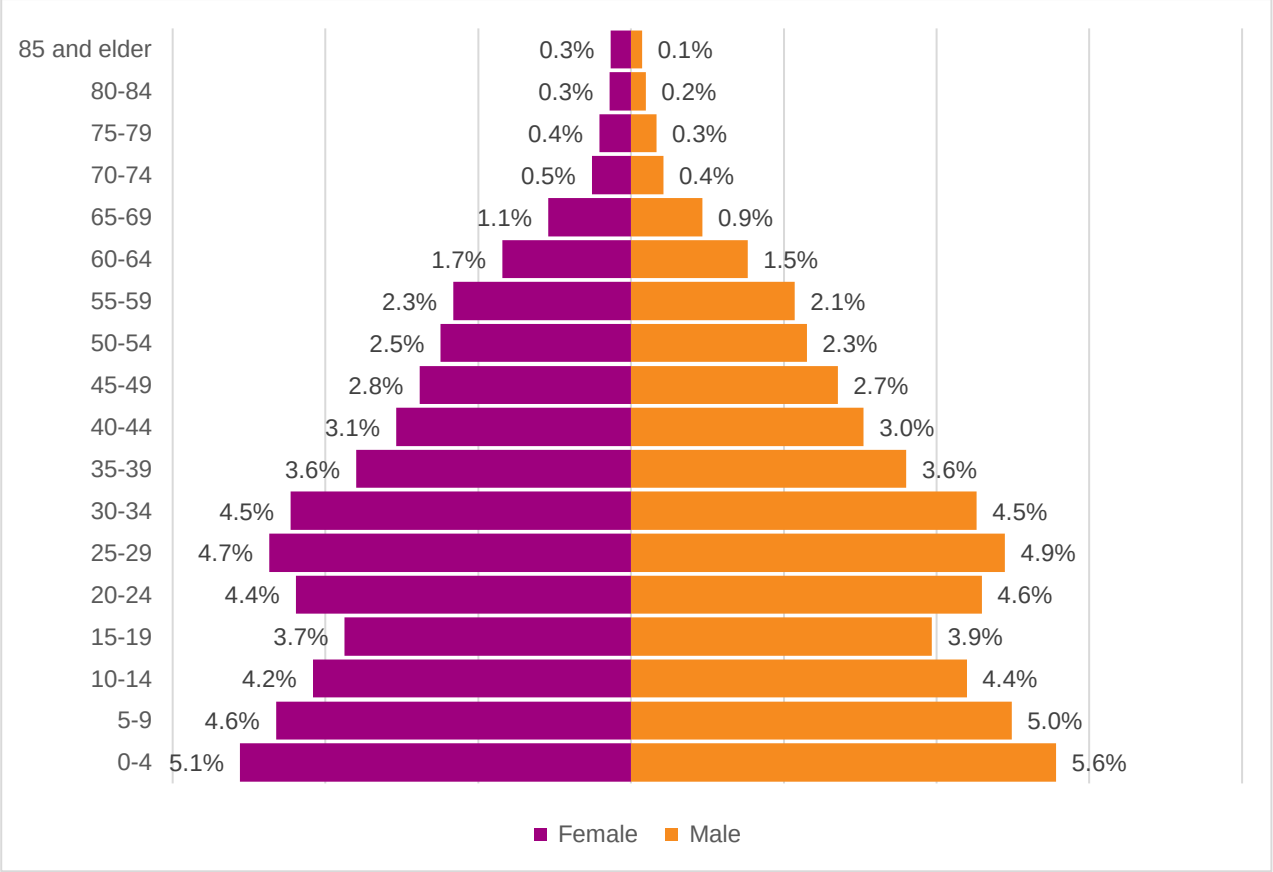

Figure 6-36: Population distribution by age – Uzbekistan[48]

The Navoi Region has a population 992,500[49] (as of 1 October 2019), or about 3% of the whole population of Uzbekistan. This figure is almost equally split between the urban (483,300) and rural (509,200) population. Navoi is the second least populated region of Uzbekistan after Syrdarya. Within the region, the population of Navoi/Karmana District is estimated to represent around 129,300[50] people. Approximately 700 residents were identified in the vicinity of the Project according to the ESSR (600 in Uzumzor and 100 in the residential cluster). The availability of population and age distribution data is limited at the local level. However, current and future site visits will confirm these figures.

Density[51]

With the lowest density relative to the countrywide average density of 72.2 people per sq. km, Navoi Region, home to the Kyzylkum Desert, has a population density of 8.6 people per sq. km. However, the Navoi/Karmana District itself has a density of 129.9 people per sq. km, a discrepancy in part explained by the presence of the administrative regional capital, Navoi (density of 2,712 people per. sq. km), within the district, pushing the average upwards. Outside of the capital, the rest of the district is then likely to be as sparsely populated as the region.

Ethnic composition

As can be seen in Figure 6-37 below, the population of Uzbekistan comprises a majority of Uzbeks (80%), as well as other ethnic minorities i.e. Tajiks, Kazakhs, Russians and Karakalpaks. However, there are some controversies

[48] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Population distribution by age – Total. [online] Stat.uz. Available at: http://web.stat.uz/open_data/data.php?value=1.1%20Population_eng_total.xlsx&lang=en [Accessed 5 Mar. 2020].
[49] State Committee of the Republic of Uzbekistan on Statistics (n.d.). The number of urban and rural population by region. [online] Stat.uz. Available at: http://web.stat.uz/open_data/data.php?value=13.3%20The%20nuber%20of%20urban%20and%20rurel%20population%20by%20region.xlsx&lang=en [Accessed 5 Mar. 2020].
[50] Navoi region official website (n.d.). Навоий вилояти ҳокимлиги. [online] www.navoi.uz. Available at: http://www.navoi.uz/uz/menu/karmana-tumani-hokimligi [Accessed 5 Mar. 2020].
[51] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Diagramma va grafiklar. [online] stat.uz. Available at: https://stat.uz/uz/index.php?option=com_content&view=article&id=5742&catid=2&lang=uk-UA [Accessed 5 Mar. 2020].

among scholars around the number of Tajiks in the country[52]. Official regional data indicate a larger proportion of Uzbeks within the Navoi District (96.4%), meaning that it might be unlikely to find specific data regarding presence of minorities in the Project AoI. However, given uncertainties around ethnic-related official sources, especially at local level, site visits will identify any significant ethnic minority group present within the Project AoI. Following consultations undertaken in March 2020, it should be noted that there are no indigenous groups identified in the area.

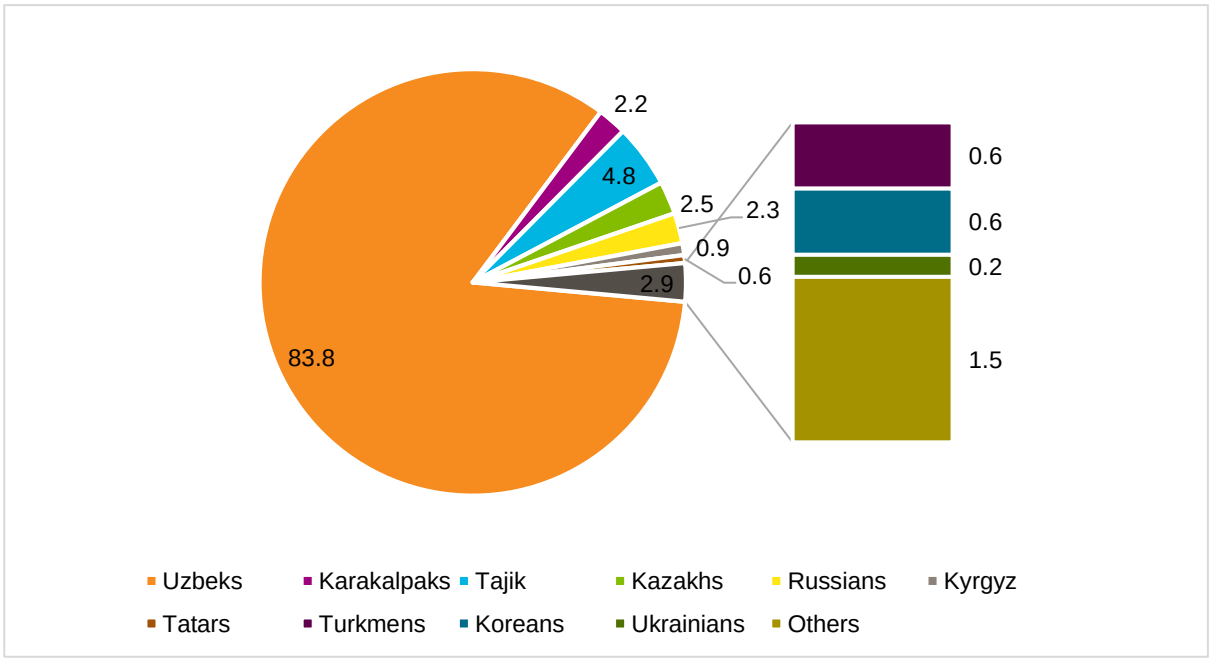

Figure 6-37: Ethnic structure of the Republic of Uzbekistan (2017, %)[53]

During a meeting organised with local institutional stakeholders in March 2019, the representative from the local Council reported that there are over 21 families in need of social protection (six of which receive additional economic support from the government) located in Uzumzor.

6.7.4 Education

According to the UNESCO Institute for Statistics, the gross primary school enrolment ratio of Uzbekistan was 104.233% in 2018. Uzbekistan has a high ratio, which has been increasing continuously since 2010, when it was at a lower percentage point of 92[54]. A slightly higher ratio for males (104.997) than for females (103.428) must be noted. Site visits and meetings have noted the presence of primary and secondary schools and an enrolment rate of 100% for girls and boys in the Council.

Table 6-9 below presents the number of educational institutions and students in Navoi/Karmana District compared with the region, adjacent districts and Samarqand Region. Navoi Region has significantly less educational institutions (358) than Samarqand (1,225). Navoi District, despite the presence of many students (21,687 or 13% of all students in the region), has the smallest number of educational institutions of all geographies shown in Table 6-9. In Navoi District, the average number of students per institution is 657, compared with an average of 428 across the other geographies. This suggests a shortfall in educational institutions within the district.

[52] Foltz, R. (1996). The Tajiks of Uzbekistan. Central Asian Survey, 15(2), pp.213–216.
[53] State Committee of the Republic of Uzbekistan on Statistics (2017). Analytical materials - DEMOGRAPHIC SITUATION IN THE REPUBLIC OF UZBEKISTAN. [online] stat.uz. Available at: https://stat.uz/en/435-analiticheskie-materialy-en1/2075-demographic-situation-in-the-republic-of-uzbekistan [Accessed 5 Mar. 2020].
[54] UNESCO Institute for Statistics (n.d.). UIS Statistics. [online] data.uis.unesco.org. Available at: http://data.uis.unesco.org/# [Accessed 5 Mar. 2020].

Table 6-9: Education facilities in different geographies, 2019[55]

Geography	Number of educational institutions, units	Number of students in general education institutions, people	Students per education institutions
Navoi Region	358	171,230	478
Navoi/Karmana District	33	21,687	657
Kyzyltepa District	41	22,900	559
Navbakhor District	36	17,760	493
Kanimekh District	35	5,527	158
Khatyrchi District	88	32,941	374
Nurata District	56	16,464	294
Samarqand Region	1,225	683,519	558
Pakhtachi District	47	23,856	508

6.7.5 Transportation

As can be seen in Table 6-10 below, automobiles are the most commonly used mean of transport in Uzbekistan. Their use has experienced a 78% increase since 2000 while railroad has also increased – yet only slightly. However, the use of trolleybus, tram and metro have all decreased (-99%, -95% and -45% respectively). According to the ESSR, mobility in the study area mostly relies on taxis and minibuses. Further research should be done to confirm this information and further investigate the state of public transport to understand the possible impacts of the Project on the local transport infrastructure.

Table 6-10: Passenger transportation by transport type in Uzbekistan (per million population)[56]

	2011	2012	2013	2014	2015	2016	2017	2018
Passengers transported, mln. persons	4,508	4,763	4,910	5,170	5,380	5,560	5,679	5,952
of which:								
railroad	15	16	17	19	20	21	21	22
automobile	4,411	4,664	4,816	5,079	5,293	5,481	5,591	5,853
trolleybus	0.7	0.3	0.4	0.9	0.8	0.8	0.5	0.5
tram	15	15	15	15	11	3	2	4
metro (subway)	64	66	59	54	52	53	62	69
air	2	3	2	2	2	2	2	3

The study area is accessible via a network of secondary roads which intersect the M37, a two-lane carriageway road connecting Navoi with Turkmenistan and Samarkand. A train station is identified south of the residential cluster, about 10km south-east of the Project site. Navoi Canal is located directly south of the M37 and is linked with the town of Navoi. It is unclear, however, whether it is used as a mean of transport. Other notable transport infrastructure within the district include the Navoi-Uchkuduk railroad and the Navoi Airport.

[55] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Diagramma va grafiklar. [online] stat.uz. Available at: https://stat.uz/uz/index.php?option=com_content&view=article&id=5742&catid=2&lang=uk-UA [Accessed 5 Mar. 2020].
[56] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Passenger transportation and passenger turnover by transport type. [online] Stat.uz. Available at: http://web.stat.uz/open_data/data.php?value=12.5%20Passenger%20transportation%20and%20passenger%20turnover%20by%20transport%20type.xlsx&lang=en [Accessed 5 Mar. 2020].

6.7.6 Public Health

According to the World Bank and national statistics, life expectancy at birth has continuously been increasing in Uzbekistan, from 58 in 1960 to 74.6 in 2018. On average, women live five years longer than men. Table 6-11 below compares life expectancy at birth between Uzbekistan, Navoi Region, and the adjacent regions of Bukhara and Samarkand. The Navoi Region has one of the longest life expectancies at birth in Uzbekistan, higher than the national average and Samarkand, but lower than across Bukhara. Overall, Navoi Region is performing better on health-related indicators than the average for the country. For example, 1.5% of children were underweight in Navoi in 2012, below the national average of 1.8%[57].In a similar vein, Navoi has one of the lowest rates of infant mortality, with 7 per 1,000 births compared with 9.9 across the country. In general, infant mortality rate is higher in urban (11.6) compared with rural areas (3.5). However, the maternal mortality ratio for Navoi in 2018 is 27.8 per 100,000 births, which is higher than the ratio of 20.2 observed across the country and is the second highest in the country[58].

Table 6-11: Life expectancy at birth, 2018[59]

	Both genders	including:	
		women	men
The Republic of Uzbekistan	74.6	77.0	72.3
Bukhara	76.6	78.4	74.7
Navoi	75.8	77.6	74
Samarkand	74.8	77.1	72.5

Health facilities

Data on the number medical facilities are available at the national and regional level. In 2018 across the country, there was an average of 46.6 hospital beds per 10,000 population compared with 55.9 in 2000. Overall, there has been a decrease in the number of health facilities available. For example, the number of hospitals went from 60 in 1991 to 29 in 2015.

Table 6-12 below provides some data regarding the number of hospitals, rural doctors' stations and the number of outpatient clinics in Navoi Region and the two adjacent regions. In absolute numbers, Samarkand and Bukhara have more facilities than Navoi, which is explained by their larger population. To allow comparison, a rate of provision (RoP) per 100,000 people was calculated. As such, Navoi has a higher of provision relative to its population. For example, there are 27 outpatient clinics per 100,000 population compared with 11 in Samarkand. Locally, the ESSR mentions the existence of one primary health unit in the study area.

Table 6-12: Medical facilities in Navoi Region[60]

Categories	Navoi	RoP	Samarkand	RoP	Bukhara	RoP
Number of hospital facilities, unit	31	3	85	2	81	4
Rural Doctors' Stations (Urban and Maternity Doctors)	55	6	127	3	93	5
Number of outpatient clinics, units	269	27	428	11	486	25

[57] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Percentage of underweight children - Total. [online] Stat.uz. Available at: http://web.stat.uz/open_data/data.php?value=5.3%20OD_underweight_children_eng_total.xls&lang=en [Accessed 5 Mar. 2020].
[58] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Maternal mortality ratio - Total. [online] Stat.uz. Available at: http://web.stat.uz/open_data/data.php?value=6.1%20OD_Maternal_mortality_eng.xls&lang=en [Accessed 5 Mar. 2020].
[59] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Life expectancy at birth. [online] Stat.uz. Available at: http://web.stat.uz/open_data/data.php?value=13.8%20Life%20expectancy%20at%20birth.xlsx&lang=en [Accessed 5 Mar. 2020].
[60] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Diagramma va grafiklar. [online] stat.uz. Available at: https://stat.uz/uz/index.php?option=com_content&view=article&id=5742&catid=2&lang=uk-UA [Accessed 5 Mar. 2020].

6.7.7 Utilities

This section focuses mainly on access to sanitation and water utilities in Uzbekistan. The entirety of the population has access to some sanitation facilities. However, in rural areas, 19.1% of the population has access to unimproved water source[61]. According to the ESSR, 100% of the households (Uzumzor) are connected to the fresh water, gas and electricity system. This information should be verified as only 31.1% of the rural population of Uzbekistan is using safely managed drinking water as shown in Table 6-13 below.

Table 6-13: Proportion of population using safely managed drinking water services[62]

Categories	%
People using safely managed drinking water services, urban (% of urban population)	86.5
People using safely managed drinking water services, rural (% of rural population)	31.1

6.7.8 Labour and Working Conditions

This section reviews the employment, labour market and working conditions in Uzbekistan using publicly available secondary data, as well as evidence collected during sites visits.

National statistics show an increase in the share of unemployment in recent years, ranging from 4.9% to 5.2% between 2009 and 2016 and reaching 9.3% in 2018. In 2018, the level of unemployment in Navoi Region was less significant (8.7%) than across the country (9.3%). In 2020, the proportion of the population at working age was also higher in the region (60.2%) than across the country (58.9%). In the district, 4,400 people are reported to be unemployed. A previous study by Typsa in 2019 noted that there are high rates of unemployment (80% of the working age population) in the residential area located approximately 2 km due south of the Project site.

There is little data available on working conditions in Uzbekistan. Given that the local district economy relies mostly on agricultural activities, this potential risk is relevant to understand the area background. It was reported that the Labour Department is staffed with respectively six and two organisational health & safety and labour & working conditions inspectors. They follow an inspection schedule sent by the Ministry on a yearly basis to inspect a number of facilities in the region without prior notification. In case of violations, offenders can be fined from five to ten times the minimum salary. During another meeting organised with local level institutional stakeholders, it was reported that women usually work in the textile and service industries as well as picking cotton, while men usually work in farming, mining or production. During this meeting, a representative from the Women's Issues Committee also reported that there are no obstacles for women to access the job market despite difficulties to access certain positions for due to cultural and tradition reasons.

6.7.9 Current Land Use

Preliminary work has identified that land in the Project area was predominantly used for grazing. No instances of soil pollution incidents (e.g. used oil, fuel, etc.) were observed during the site visit in the areas that were visited. The visit has also revealed the existence of two farms within the Project area: the Hamraqul Baraka farm ("Farm A") and the Mehrigiyo farm ("Farm B"). Following consultation with the State Cadaster in March 2020 it is understood that the Government initiated the process of acquiring the land for the Project. The two owners of these farms surrendered their lease of the land identified for the Project. The Cadaster confirmed that this was triggered by the call for tender. Both leaseholders have now had some of their land reduced. It was noted that one leaseholder had subleased the farming land to a tenant who was continuing to use the land for grazing at the time of the March 2020 site visit.

The reduction in farm area is shown below in Table 6-14 below.

[61] Unimproved drinking water - use of any of the following sources: unprotected dug well; unprotected spring; cart with small tank or drum; tanker truck; surface water, which includes rivers, dams, lakes, ponds, streams, canals or irrigation channels; or bottled water.
[62] State Committee of the Republic of Uzbekistan on Statistics (n.d.). Proportion of population using safely managed drinking water services. [online] Stat.uz. Available at: http://web.stat.uz/open_data/data.php?value=15.13%20safe_drinking_water_eng.xlsx&lang=en [Accessed 5 Mar. 2020].

Table 6-14: Reduction in farming area

Farm	Land Size (before optimisation)	Land size (post optimisation)	% of original land remaining
Farm Hamraqul Baraka (Farm A in the ESSR)	158.73 ha	73.67 ha	46.41%
Farm Mehrigiyo (Farm B in the ESSR)	325.84 ha	7.7 ha	2.36%

It was reported that no complaints were received following the reduction of land. It was noted that no applications for the provision of new plots for grazing purposes were received.

During the March 2020 site visit it was noted that Farm B are still using the original land without a contract or agreement from the administration. It is considered that the government's lack of action in allowing continued occupation is deemed to be a form of permissive usage. This will be monitored and clarified during additional site visit planned in June 2020.

6.7.10 Potential Receptors

This section identifies the potential socio-economic receptors that exist within the Project AoI. For the purposes of the assessment, potential receptors are defined as elements of the socio-economic environment which may interact with the Project activities or perceive an effect or change to their life conditions / quality of life as compared to their baseline characteristics, as shown previously in this section. The following table lists the potential socio-economic receptors drawn from the baseline study.

Table 6-15: Potential socio-economic receptors

Receptor	Description
Project workforce	The Construction workforce will either be based on site in a workers camp or within hotel or guest house accommodation in the nearby AoI. Operational workforce will likely be housed within the AoI as well. Associated risks of accident and ill health due to living or working conditions are relevant for this receptor, as well as their potential interaction with nearby communities.
Local economically active population	Project related employment and training needs may interact with the local economically active population. This receptor may encompass people living within the AoI.
General local businesses, services providers and equipment suppliers	Project related procurement needs during the construction and operation phases may interact with local businesses, services providers and equipment suppliers (e.g. limited use of the local shops, procurement of equipment and materials supplies).
Communities	Settlements in the AoI: Core AoI (Farms A and B), Direct AoI (Uzumzor and Southern Settlement), and Indirect AoI (Urumzor, Khazara and the Eastern Settlements), along M37.
Road users	Existing and future road users on M37, the road from the M37 to Khazara and the dirt roads within the Project area, including road capacity which may be subject to changes in traffic / vehicle load. As mentioned above, due to a lack of accurate traffic flow data, a qualitative approach from site visit observations was taken to account for estimated traffic changes.
Vulnerable groups	Groups with limited coping / adaptation capacities to external changes. Particular consideration is given to children, women and the elderly in the AoI. No indigenous peoples have been identified in the AoI but herders from Farms A and B may be considered as vulnerable due to their proximity to the site and limited control over their land leases if they are sub-leasing from land owners, as is the case with Farm B.

Source: AECOM 2020

6.8 Transportation and Access

6.8.1 Introduction

At this stage the decision has not been made on the final solar PV supplier therefore the exact transport route is not yet known. However, it has been assumed that the Solar PV components will be transported over land from a manufacturing plant in China, via Kazakhstan to the Project site. All goods are divided into two modes of transportation based on size:

- For conventional goods, the equipment that can be carried by railway containers is transported by railway containers; all goods are sent from the Xi'an Xinzhu Railway Port to the Project site;
- For equipment that cannot be carried by railway containers, it will be exported from Xinjiang via Khorgos Port to reach its destination by truck.

The proposed road transport route from the China/Kazakhstan border is shown in Appendix A.

6.8.1.1 Baseline Data Collection

A desktop review and site visits (undertaken in March 2020) have been undertaken to identify any key issues with regard to accessing the site and to consider potentially suitable access routes from an appropriate port or main road. This high-level route assessment was based on existing maps, satellite imagery and information gathered during the site visit.

There has been no data available to estimate the current national traffic volumes on the proposed roads to be used for transportation of materials on the site.

6.8.2 Baseline Conditions (Road)

6.8.2.1 Transportation Route

The transportation study has considered a route from China where the parts will be delivered up to the Project site utilising the main transport network and avoiding built-up areas where possible.

The Chinese border crossing is located over 1,000 km east of the project site and it is understood to be key for importing and exporting goods in and out of inland central Asian countries, including Uzbekistan. Further work will be required to confirm the suitability of the route and border crossing for delivering and handling the Project materials.

The Project site can be accessed directly from the M37 via a short dirt road thereby reducing the need for use of local, unpaved roads to any extent.

Given the likely importance of the route for trade between China and Central Asian countries, it is anticipated that the road infrastructure between the border and the site will be of good quality and should not present any significant technical difficulties.

A more detailed assessment would be required to confirm the suitability of this route and/or to identify alternatives however, a potentially suitable access route has been identified for the purposes of this assessment.

The proposed route comprises the following key roads (distances noted are estimates):

- From border crossing at Khorgas leave the G312 from China and join the A535 in Kazakhstan.
- Continue west on the A353 to Saryokez – 250km.
- Take the route to the south of Saryozek and join the A3 at Dos – 5km
- Continue of the A3 to Almaty – 100km
- Before reaching Almaty turn right onto the P-19 and continue to Chapayevo.
- Turn right staying on the P-19 to Mezhdurechenskoye.
- Join the M-36 to Shamalgan, turn left then right and follow the M-37 to Kaskelen.
- Turn right on the A-2 and continue on the A-2 via Taraz and Shymkent to the Uzbek border at Yallama – 700km.

- Cross into Uzbekistan and turn right at Chinaz to join the M39.
- Continue west for 5km, bearing right to continue on the M-39.
- Continue on the M-39 crossing back into Kazakhstan for 10km before reaching Samarkand – 150km.
- On reaching Samarkand turn right onto the M37 and continue to Navoi – 200km
- Continue on the M37 from Navoi to the junction to the unmarked road to Uzumzor.
- After 1 km take a right on the next junction on the unmarked road to the site entrance.

Figure 6-38: View in the direction of the project site along the M37

6.8.2.2 Road Description

National Road A353

The road was not visited as part of the preliminary ESIA visit in March 2020. However, it is understood to be dual carriageway at least in sections and is used by HGV traffic. It is deemed suitable to use for delivery purposes and can accommodate HGV traffic.

National Road A3

The road was not visited as part of the preliminary ESIA visit in March 2020. However, it is understood to be dual carriageway at least in sections and is used by HGV traffic. It is deemed suitable to use for delivery purposes and can accommodate HGV traffic.

National Road A2

The road was not visited as part of the preliminary ESIA visit in March 2020. However, it is understood to be dual carriageway at least in sections and is used by HGV traffic. It is deemed suitable to use for delivery purposes and can accommodate HGV traffic.

M39 Highway

The road was not visited as part of the preliminary ESIA visit in March 2020. However, it is understood to be dual carriageway at least in sections and is used by HGV traffic. It is deemed suitable to use for delivery purposes and can accommodate HGV traffic.

M37 Highway

The M37 is dual carriageway between Navoi and the site. The road is used by HGV traffic and is the main road between Samarkand, Navoi and Bukhara. This is considered the most suitable road to use for delivery purposes and is deemed suitable of accommodating delivery HGV traffic.

Minor Road to Site

The Project site is accessed from the M37 via a short stretch of minor road. Further grading of this road may be required for larger vehicles to access the site. Most of the road does not allow for vehicular travel faster than 40 km / hr. The road is generally wide enough to allow for two vehicles to travel in opposite directions, however the road conditions would typically require vehicles to go on a narrower shared pathway.

6.8.3 Road Safety

Both Kazakhstan and Uzbekistan have relatively poor road safety records. According to the World Health Organisation (WHO) Road Safety Report, 2018[63], in 2016, there were 17.6 deaths per 100,000 population in Kazakhstan with the greatest proportion of these being drivers (60%) then pedestrians (31%). However, fatalities have more than halved in the past 10 years. In Uzbekistan, there were 11.5 deaths per 100,000 population which has increased slightly since 2007.

6.8.4 Roads Sensitivity Analysis

Table 6-16 sets out the level of sensitivity of the different sections of roads along the proposed route considering the type of road, current traffic volumes and the presence of any sensitive receptors.

Table 6-16: Sensitivity Analysis

Road	Receptor Details	Sensitivity
Road A353 (Kazakhstan)	Paved highway with medium daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Highway suitable for all types of vehicles and volumes.	Low

[63] World Health Organization (2018). Global Status Report on Road Safety 2018. Geneva: World Health Organization.

Road	Receptor Details	Sensitivity
Road A3 (Kazakhstan)	Paved dual carriageway road with moderate daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Highway suitable for all types of vehicles and volumes.	Low
Route A2 (Kazakhstan)	Paved highway with moderate daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Highway suitable for all types of vehicles and volumes.	Low
M39 (Uzbekistan)	Paved dual carriageway road with moderate daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Road suitable for and regularly used by HGVs	Low
M37 (Uzbekistan)	Paved highway with moderate daily traffic flows. Recently upgraded and rehabilitated. Minor traffic management measures in place. Roads suitable for and regularly used by HGVs.	Low

6.8.5 Rail Transport

The railway shipments are all containerized. Goods will be loaded at the Xi'an Xinzhu Railway Station warehouse, China and the arrival point will be Tashkent Chukursay Station. The containers are then transported to the project site using customs supervision vehicles. The empty containers are returned to Tashkent.

The "Chang'an" train runs from Xi'an to Horgos Port, covering a total distance of 3,200km. It passes through three railway bureaus and 10 marshalling stations and arrives at Horgos Port within three days.

On leaving China, the railway transportation route is 1,600km in total, passing through four marshalling stations, the Kazakhstan Railway and Uzbekistan Railway - Almaty, Shimkent, and Tashkent. After reloading at Altynkol Station, the train reaches Chukursay station in Tashkent, where materials are then transferred to the Project site.

7. Preliminary Impact Assessment

7.1 Construction Phase Impacts

The assessment has been undertaken in accordance with the criteria set out in Section 4 (Assessment Methodology). The impacts, including magnitude of change, are discussed in further detail below.

7.1.1 Hydrology and Hydrogeology

7.1.1.1 Surface Water

There are two permanent surface water bodies on the eastern and western boundaries of the Project site. Furthermore, there are a number of smaller drainage routes eventually draining to the Zarafshan River to the north. The Zarafshan River provides the main source of irrigation across the region.

Surface water may be subject to reduction in quality should proper mitigation not be implemented. The irrigation canals adjacent to the site currently provide drinking water for livestock and are used to supply irrigation water for smallholder vegetable farming for local farmers.

During construction, earthworks, road construction and use of heavy vehicles could alter surface drainage patterns. The removal of vegetation and compaction of soils will reduce infiltration and surface run-off will increase. The risk is greatest during severe precipitation events; based on rainfall data this is most likely to occur in December. The increased volume of water flowing into drainage channels is likely to cause additional soil erosion. Surface run-off will also contain higher concentrations of suspended sediments during construction than would otherwise be the case. Other potential sources of pollution during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater.

Impact Assessment: Impacts on surface water during construction					
Impact Nature	Positive		Negative		
	Impact is negative because construction activities may generate pollutants that reduce the quality of surface water used by local residents for crops and as a drinking water source for livestock.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is generally direct and potential sources of pollution to surface water during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater which may subsequently run off to nearby surface water bodies. Surface water run-off may have a higher sediment load. The localised nature of spills likely to be experienced can be addressed through standard construction practises including appropriate drainage and containment. Pollution risks will continue during the construction phase.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 9-12 months.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and run-off from potential spills or sediment would be at a local level only. Chemicals and fuels are not stored in sufficient quantities to result in a spill of regional importance.				
Receptor Value / Sensitivity	Low	Medium	High		
	The sensitivity of surface water is assessed as medium, recognising the fact that only small number of local residents use these two irrigation canals for vegetable farming and for drinking water for livestock. The irrigation canals are all man made and would provide a significant residence time allowing sediment to settle out prior to discharge back to the Zarafshan River.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be low given the limited area of the Project site in relation to the overall catchment area.				

Impact Assessment: Impacts on surface water during construction					
Impact Significance	None	Negligible	**Low**	Medium	Major
	As a result, the significance of the impact is assessed as low. The extent of reduced surface water quality due to construction activities is considered local, and the duration assessed as being temporary and short-term. A low impact does not require additional mitigation measures to be implemented. Mitigation will involve the implementation of Good International Industry Practise pollution prevention measures.				

7.1.1.2 Groundwater

There are currently three options being considered to supply water to the Project: direct abstraction from the drainage channel, groundwater well or purchase of water and delivery by truck.

Local communities within the vicinity of the Project use the drinking water mains supply for domestic use.

Potential sources of pollution to groundwater during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater. During construction, sanitary waste will be collected in containers below portable toilets and transported to a registered waste disposal facility for disposal. Storage and handling procedures for oils and other chemicals will be required to minimize risk of pollution.

Potential impacts on groundwater include:

- Accident/ unplanned event: Groundwater could be contaminated through accidental fuel spills.
- Accident/ unplanned event: Depending on the method of waste disposal, impacts could be felt on surface or groundwater, flora and fauna and/ or local communities.

Impact Assessment: Impacts on groundwater during construction					
Impact Nature	Positive			**Negative**	
	Impact is negative because construction activities may generate pollutants that reduce the quality of groundwater used by local residents for domestic purposes.				
Impact Type	**Direct**		Indirect	**Reversible**	Irreversible
	The impact is generally direct and potential sources of pollution to groundwater during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater. The localised nature of spills likely to be experienced can be addressed through standard construction practises including appropriate drainage and containment. Pollution risks will continue during the construction phase.				
Impact Duration	**Temporary**	**Short-term**	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 9-12 months.				
Impact Extent	**Local**		Regional	National	
	The impact is expected to occur within the site and run-off from potential spills would be at a local level only. Chemicals and fuels are not stored in sufficient quantities to result in a spill of regional importance.				
Receptor Value / Sensitivity	Low	**Medium**		High	
	The sensitivity of groundwater is assessed as medium given reported poor water quality, recognising the fact that local communities do not abstract groundwater for domestic use from boreholes located in surrounding villages.				
Impact Magnitude	No change	Very Low	**Low**	Medium	High
	The magnitude of the effect is predicted to be low, given that the soil and superficial deposits present in the area are expected to provide protection to the groundwater in the crystalline basement rock.				
	None	Negligible	**Low**	Moderate	High

Impact Assessment: Impacts on groundwater during construction	
Impact Significance	As a result, the significance of the impact is assessed as low. The extent of reduced groundwater quality due to construction activities is considered local, and the duration assessed as being temporary and short-term. A low impact does not require additional mitigation measures to be implemented. Mitigation in this case will involve the implementation of Good International Industry Practise pollution prevention measures.

7.1.2 Landscape and Visual

7.1.2.1 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 7-1.

Table 7-1. 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 7-2.

Table 7-2. 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 7-3.

Table 7-3. Project Landscape and Visual Receptor Sensitivity

Receptor	Sensitivity
Landscape Character Areas	
LCA01	Low
LCA 02	Low
LCA 03	Low

LCA 04	Low
Human Receptors	
Residential receptors	Low
Recreational receptors	Low
Highway receptors	Low

7.1.2.2 Impacts on Landscape Character and Visual Amenity

These include areas for temporary works, construction compounds, access road and on-site roads, areas for solar PV panels, substations and transformer stations, on-site and off-site transmission lines. New machinery and equipment will be introduced into the landscape, including heavy goods vehicles excavators, bulldozers, and other heavy equipment.

The main source of impact to the LCTs during operation is the erection of the solar PV panels, and associated foundations, inverters and substation.

Other elements of operation of the Project that will affect the landscape comprise:

- Off-site features, including power lines that will be supported by transmission poles to transmit electricity from the Project site to the connection point.
- On-site roads, including access roads, and occasional vehicles that pass along the roads.
- Additional structures at the Control Centre, including the electrically sub-station.

Impact Assessment: Impacts on Landscape Character					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities will result in additional features within the LCAs. It is assumed that all Project related changes are negative in nature..				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is generally direct and experienced within 5km of the Project site. The impact will continue for the duration of the Project and is therefore deemed to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The construction impact is short-term as construction works are expected to continue for a period of approximately 9-12 months. However impact will continue for the duration of the Project lifetime.				
Impact Extent	Local	Regional	National		
	It is assessed that only a small proportion of the local landscape will be affected by the presence of construction works, topsoil stripping and bare ground.				
Receptor Value / Sensitivity	Low	Medium	High		
	The sensitivity this LCT is assessed to be Low as it is not important in a local context, including visitors to the area who generally travel to this region to visit the Deggaron mosque or other sites on the Silk Road. It is noted that the LCT is not designated at the local or national level. The landscape in the wider area is industrialised which determines the overall character of the Navoi region as a whole.				
Impact Magnitude	No change	Low	Medium	High	
	The magnitude of the effect is predicted to be low, as it is unlikely that construction works become the dominant feature in an area already impacted by human activity.				
Impact Significance	None	Negligible	Low	Moderate	High
	As a result, the significance of the impact is assessed as low. Although impacts will be visible in places, the surrounding features such as OHLs and pylons are of a larger scale in height and extent. Therefore, changes can be easily accommodated in all LCTs.				

Impact Assessment: Impacts on Visual Amenity					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities will result in additional features within the LCAs. It is assumed that all Project related changes are negative in nature..				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct and experienced within 5km of the Project site. The impact will continue for the duration of the Project and is therefore deemed to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The construction impact is short-term as construction works are expected to continue for a period of approximately 9-12 months. However, impact will continue for the duration of the Project lifetime.				
Impact Extent	Local		Regional	National	
	It is assessed that the views experienced will include OHLs and pylons, roads, substation and other man made structures which reduce the quality of the views experienced.				
Receptor Value / Sensitivity	Low		Medium	High	
	The sensitivity of all VPs are assessed to be Low as they are not important in a local or regional context, including visitors to the area who generally travel to this region to visit the Deggaron mosque or other sites on the Silk Road. As noted, the landscape in the wider area is industrialised which determines the context of the views experienced.				
Impact Magnitude	No change	Low		Medium	High
	The magnitude of the effect is predicted to be low, given that the soil and superficial deposits present in the area are expected to provide protection to the groundwater in the crystalline basement rock.				
Impact Significance	None	Negligible	Low	Moderate	High
	As a result, the significance of the impact is assessed as low. Although impacts will be visible in places, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be easily accommodated in all LCTs. Views from the M37 will be transient in nature and again dominated by exiting vertical features in this location.				

7.1.3 Biodiversity

7.1.3.1 Avifauna

Construction impacts are likely to include habitat loss as well as disturbance impacts in the Project and adjacent areas. However, the degraded nature of the Project site and the relatively small number of birds encountered mean that there is not likely to be a significant impact on resident bird species.

Large avifaunal species utilise large tree species and these are not present within the PV area of the site, thus the Project is not expected to affect successful breeding of local large bird species (such as raptors).

Habitat loss associated with construction is unlikely to result in a significant impact to migrating birds as no major attractant features (e.g. lakes / wetlands) will be lost. As a result, there are not anticipated to be any impacts on resting or stopover sites for migrating birds.

Impact Assessment: Impacts on ornithology during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in habitat loss and disturbance.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct as habitat will be lost through construction activities (e.g. ground clearance to accommodate infrastructure), this could include direct destruction or damage to bird nests. In addition, disturbance caused by construction activities may directly displace birds from breeding sites and/or foraging areas.				
	Temporary	Short-term	Medium-term	Long-term	Permanent

Impact Assessment: Impacts on ornithology during construction					
Impact Duration	The impact is permanent as there would be an irreversible change to the baseline within the Project site for the lifetime of the Project. Displacement impacts are temporary and short-term as construction works are expected to continue for a period of approximately 9 months.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site. No designated sites are in proximity to the site. There is potential for a number of species of conservation concern to frequent the area of the proposed project however this is deemed unlikely.				
Receptor Value / Sensitivity	Low	Medium	High		
	The PV footprint is highly disturbed and thus it is considered unlikely to support a rich avian community. There is the potential for a number of species of conservation concern to frequent the area of the proposed project however this is deemed unlikely. Sensitivity is determined as Low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be Medium given the area of the Project site that will require to be cleared and / or disturbed.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as minor and not significant, however it is recommended standard mitigation measures are implemented to ensure impacts remain minimal.				

7.1.3.2 Terrestrial Ecology

Potential impacts on flora and fauna arising during construction comprise:

- Direct loss of vegetation and habitat (including food sources).
- Direct loss of fauna during construction activities.
- Indirect impacts associated with pollution.
- Disturbance of fauna from presence of people, machinery, traffic, and noise, both within and outside of the Project area.

Areas of habitat and flora will be lost due to construction activities and in particular due to earthworks for the substation and invertor buildings, solar PV foundations and electrical transmission connections; on-site construction roads and construction of off-site access road and power transmission line.

The natural vegetation at the Project site has been substantially altered by human activities, especially farming and irrigation. Due to the high level of anthropogenic disturbance to the natural vegetation and limited diversity on the Project site, there is little natural ecosystem function demonstrated by the site and it is therefore not considered a sensitive area.

Much of the existing vegetation will be removed during construction to minimise shading and improve energy yield.

Impact Assessment: Impacts on terrestrial ecology during construction				
Impact Nature	Positive	Negative		
	Impact is negative because construction activities may result in habitat loss and disturbance.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is generally direct as habitat will be lost through construction activities (e.g. removal of habitat to accommodate infrastructure), this could include direct destruction of flora or damage to fauna habitat. In addition, disturbance caused by construction activities may directly displace / disturb fauna. Construction vehicles and excavated areas can pose a risk of death or injury to fauna.			

Impact Assessment: Impacts on terrestrial ecology during construction					
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent as there would be an irreversible change to the baseline within the Project site for the lifetime of the Project. Displacement impacts are temporary and short-term as construction works are expected to continue for a period of approximately 9 months.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site. No designated sites are in proximity to the site. There is potential for a number of species of conservation concern to frequent the area of the proposed project however this is deemed unlikely.				
Receptor Value / Sensitivity	Low	Medium	High		
	The abundance and diversity of terrestrial fauna was found to be low. A single species of conservation concern was recorded: Central Asian tortoise (IUCN VU). However, there is no reasonable likelihood that the tortoise population occurring within the Project site is of regional importance. The sensitivity of the terrestrial habitat has been precautionary assigned as Medium and this assessment is based on the IUCN (VU) status fo Central Asian tortoise. Other plant and animal species recorded during the AECOM are not of conservation concern however this will be confirmed following the further ecological surveys which are programmed for late June 2020.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be Medium given the area of the Project site that will require to be cleared and / or disturbed.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as Medium and significant. As a result a suite of both standard mitigation measures and species specific mitigation measures will be implemented to ensure impacts are reduced to Low significance or below.				

7.1.4 Geology and Soils

7.1.4.1 General

The main impact on soils during construction will be the potential for soil contamination from spills and leaks and increase in vulnerability to erosion. Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable during the spring snowmelt, when vehicle traffic is likely to cause the greatest damage.

Where roads are un-surfaced, rutting and gully erosion eventually make the roads impassable so that vehicles drive off the track and the area affected by erosion continually widens.

The following types of construction activity could lead to potential soil erosion:

- Vehicle traffic along dirt tracks used during construction of on- and off-site roads, power lines, control centre and solar panels will cause soil compaction.
- Off-road vehicle traffic will damage vegetation and cause soil compaction.
- Any vegetation and some soil will be removed for the control centre, solar panel foundations, transmission towers, and both on- and off-site roads.
- The use of heavy equipment will cause soil compaction if used outside designated roads.
- Soil erosion from increased water run-off, can cause sediment release to nearby water bodies.
- Ability of soils to support foundations.

Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable during the rainy seasons, when vehicle traffic is likely to cause the greatest damage.

Where roads are un-surfaced, rutting and gully erosion eventually makes the roads impassable so that vehicles drive off the track and the area affected by erosion continually widens.

7.1.4.2 Ground conditions

Electrical equipment (transformers, inverters, electrical switchgear…) heavy duty equipment and ancillary buildings (office building, meteo towers…) are usually earthed by means of surface mats.

Although the surface of the Sandy Silt Unit could be described as “stiff” soil, because of its NSPT records and its main MH classification, the existence of a very low strength layer from a depth of around 0.8 up to 1.8 meters, suggests the likely existence of partial collapsible areas that could develop until reaching the surface, as seems to have happened on C-1 soil cut.

It is considered that collapse behavior can take place within this superficial unit in different areas of the PV parcel, even without additional loads, as has happened at C-1 soil cut.

Consequently, it is not advisable to rely on the strength of this soil to support any foundation but to go through it and lay foundations on underlying sandy and gravelly layers.

7.1.4.3 Soil and water corrosiveness

An analysis of soil induced corrosiveness was carried out based on electrical resistivity of soils. As a conclusion of that analysis, the first 0.5 to 0.9 superficial meters were labelled as “corrosive” to “highly corrosive”, while the remaining deeper soil was labelled as “essentially non-corrosive”.

As a consequence of the analysis, all units will be highly corrosive to steel because of their excessive concentration in sulphate, as well as some of them due to chloride.

Regarding aggressiveness to concrete, all units are classified as “strong attack” category because of their high sulphate concentration, as per the table below (DIN-4030).

An additional potential impact during construction is the pollution of soils from chemical spills or oil leaks from machinery, as well as incorrect disposal of waste, including accidental discharge of sanitary or other wastewaters to the local environment. Incorrect disposal of waste can occur throughout the construction phase if appropriate disposal measures are not put in place.

Impact Assessment: Impacts on soil quality during construction					
Impact Nature	Positive			Negative	
	Reduction in local soil quality as a result of construction activities causing erosion related to increased water run-off, soil compaction and loss of limited vegetation. Soil quality can also be negatively affected by spillage of oils during maintenance of machinery, improper storage of hazardous materials, spillage during transfers of fuel and improper disposal of waste.				
Impact Type	Direct	Indirect		Reversible	Irreversible
	The impact is generally direct as soils / geology resources will be affected through construction activities.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 9-12 months.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and sedimentation/oil or chemical release would be at a local level only.				
Receptor Value / Sensitivity	Low	Medium	High		
	The sensitivity of soils in the Project area is assessed as Low. Whilst it is recognised that soils will be most vulnerable during spring, the limited geographical extent does not require higher sensitivity.				
	No change	Negligible	Low	Medium	High

Impact Assessment: Impacts on soil quality during construction					
Impact Magnitude	The magnitude of the effect is predicted to be Low, given that there is potential for construction activities to notably change the resource, particularly during rainy season. Impacts of fuel spills are deemed to be highly localised.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the significance of the impact is assessed as Minor. The extent of reduced soil quality due to construction activities is considered local, and the duration assessed as being temporary and short-term.				

7.1.5 Archaeology and Cultural Heritage

The Project is not deemed to have a direct adverse impact on any international or nationally recognised cultural heritage feature and consultation confirmed that there are no significant cultural resources within the Project site.

As a result of the absence of known archaeological, religious and aesthetic sites, the site sensitivity is assessed to be low.

There is the potential for the discovery of unrecorded buried archaeological remains during the construction phase as the Project will involve ground clearance activities such as levelling, grading and excavation works. These works have the potential to directly impact on unrecorded buried archaeological remains which may be present within the site boundary and may be of archaeological importance.

It should be noted that although there are no known archaeological or religious sites located within the Project footprint, the Rabat Malik Caravanserai and other Silk Road sites are located to the east of the Project adjacent to the M37. It was noted that the Caravanserai has been rebuilt to the extent possible and bears little resemblance to its original structure. Nevertheless, this site is of cultural significance. It is imperative that these sites are not disturbed further by the Project activities, such as transportation, or by the workforce. Given the distance from the site it is considered unlikely to be directly impacted by the Project.

Impact Assessment: Impacts on archaeology and cultural heritage during construction					
Impact Nature	Positive			**Negative**	
	Impact is negative because construction activities may result in physical disturbance to cultural heritage features.				
Impact Type	**Direct**		Indirect	Reversible	**Irreversible**
	The impact is generally direct as archaeology features could be disturbed by construction activities.				
Impact Duration	**Temporary**	**Short-term**	Medium-term	Long-term	**Permanent**
	The impact is permanent as impacts occur there would be an irreversible change to the baseline within the Project site.				
Impact Extent	**Local**		Regional	National	
	Any potential impact is expected to occur within the site. There are no known designated archaeology features within the site. Any impact would be on previously undiscovered remains.				
Receptor Value / Sensitivity	**Low**		Medium	High	
	There are no known archaeological or religious sites within the Project site and there is considered low potential for unknown buried archaeological remains to survive within the site due to the past attempt to develop arable farming on the land.				
Impact Magnitude	No change		**Low**	Medium	High
	Magnitude of change is anticipated to be Low as there is limited potential to disturb any existing features. Potential impacts on undiscovered archaeology are deemed to be of low magnitude.				
Impact Significance	None	Negligible	**Low**	Medium	Major
	The impact is assessed as Low and not significant prior to mitigation measures being implemented.				

7.1.6 Noise and Air Pollution

Noise pollution may result from the large workforce and construction activities, particularly the movement of trucks used to carry material to the site and removal of debris. Some heavy earth moving, and compacting machinery may be required for brief periods during construction but it is expected that much of the civil work will involve manual labour.

Air pollution may also arise as a result of dust emanating from vehicle movements and other construction activity. However, this will be a temporary effect that can be mitigated by restricting vehicles to sealed access tracks and the use of dust suppression measures.

The Project impacts may include:

Air Quality

- Dust and engine emissions created by construction activities (i.e. earthworks, demolition and operation of machinery) could influence the local ambient air quality.
- The release of exhaust emissions to the atmosphere could have an effect on the local ambient air quality.

Ambient Noise

- Truck and vehicle traffic along main transport/access routes will create noise and vibration that may increase ambient noise levels.
- Construction equipment and machinery could create noise and vibrations that may increase ambient noise levels.

The construction of the substation building / transformers and inverters are considered a worst-case construction noise scenario. Typically, associated construction activities within a 200 m distance from noise sensitive receptors have the potential to result in increased construction noise at receptor locations. The Project layout includes a number of inverter and transformer locations toward the centre of the site at a distance of over 200 m from the closest receptors. The substation and short section of new OHL are however located to the south of the site within 200 m of receptors, there is therefore the potential for high construction noise at this location.

Impact Assessment: Impacts on noise and air pollution during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased noise and air pollution.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is direct as construction activities would directly increase noise / air pollution.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and adjacent areas.				
Receptor Value / Sensitivity	Low	Medium	High		
	No residential receptors are located within 2 km of the Project site therefore receptor sensitivity is determined to be low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Very low as there is unlikely to be any increase noise levels and increased dust / emissions to air associated with construction of the Project at nearby residential receptors.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Negligible and not significant pre mitigation. Although no specific mitigation is required, standard good construction practice will be maintained to ensure no increase in predicted impacts during construction.				

7.1.7 Social Impacts

The Project has the potential to have a number of interactions between its activities and the social receptors (Section 6.7.10) living in the AoI, both positive and negative. The following sections will describe some of these interactions in order to frame the preliminary social impacts.

Interaction between employment and capacity building

The Project will require both skilled and unskilled labour during the construction and operational phase. Labour may be sought from the local community and training provided for selected individuals, thereby creating direct and indirect employment opportunities.

As previously described, the number of local people that are to be employed during construction is expected to reach a peak of 900 personnel. This includes technicians and low-skilled personnel (approximately 600) who will receive various levels of training before staring work on the Project. The training incorporates basic training on HSE, labour management and, where required for specific job profiles, vocational training.

The construction workforce is expected to consist of a combination of nationals and expatriate workers, with the majority being local economically active population, preferentially sourced from the surrounding communities in the AoI. A Local Hiring Plan should be developed to maximise the number of local employees on the Project (see Section 8).

The total number of the local workforce is expected to increase as site preparation activities commence. After the peak level has been reached, the local workforce will gradually be reduced leading up to the start of operations.

The individuals employed during the construction stage, and their household members, will benefit from increased income. Similarly, the Project represents an opportunity for young people to increase their skills through vocational training that will be of use to them after their involvement in this Project is completed. Individuals who receive such training should be able to seek alternative work within the growing construction sector in the future.

Interaction with local communities

The Project has been located away from individual houses and local settlements and therefore there will be no requirement to re-settle any individual. As a result, physical resettlement will be avoided and a Resettlement Action Plan (RAP) for the Project is therefore not required. However, the Project will be required to lease an area currently used for grazing (Farm B) and as such there may be a negative impact on the ability of local people to maintain the same level of income and access to the area. To address this, an area of alternative land will be made available to the sub-tenants for Farm B. The Project will facilitate discussions with the Khokimyiat to ensure alternate access locations are identified during the ESIA study and will be based on engagement discussions with the previously mentioned sub-tenants.

Interactions with the workers' camp and migrant workforce

- Local Community Demographics - Influx of workers from outside of the local Project AoI may result in a change in demographics of the local communities.
- Social and Cultural Structure - The presence of workers in the Project AoI and the money they earn and spend may cause changes to local customs and norms causing social tensions and impacting on social institutions. Additionally, it may cause increased pressure on services due to a significant influx of workers from outside the local area.
- Infrastructure and Services - The presence of workers in the Project area could have an impact on local social amenities and possibly saturate existing public services (water, electricity, roads, schools, health centres).
- Increased presence of local and migrant workers looking for work opportunities near the Project AoI – The presence of workers in the Project AoI could have the potential to increase the incidence of communicable diseases, including Covid-19.

Interactions with Community H&S and Security

- Disruption during construction and reduced access to roads around the Project site during road upgrade work.
- Increased traffic and the use of the M37 road by large construction vehicles could pose a H&S risk to members of the local communities.
- Loss of public access to footpaths inside the Project site.
- Dust and engine emissions created by construction activities could impact air quality and hence community health. This impact is covered in more detail in the corresponding Air Quality section.
- Accident/ unplanned event: Degraded water quality from discharged effluent and sewerage and unplanned events could have an effect on community health. This unplanned event is covered in more detail further below.
- Equipment and activities will create noise and vibration during construction and demolition that could impact human health. This impact is covered in more detail in the corresponding section.
- Movement of materials and workers during construction could impact public safety.
- Access to water and water quality impacts could negatively affect local communities. This impact is covered in more detail in the corresponding Hydrology and Hydrogeology section.

Interactions with Occupational Health and Safety

Further to impacts identified above, construction activities pose a variety of OHS risks to the workforce arising from general construction works within the Project site, during the upgrade to the access roads, and during the interconnection to the existing transmission line poles.

- Working at height during the installation of transmission line cabling;
- Heavy lifting during installation of the solar panels by the workforce;
- Working with live electrical components during construction and operation; and
- Noise, dust and emission levels on the workforce during construction activities.

Key impacts are described in more detail below.

7.1.7.1 Social Impact List

Based on the interactions described above, the following potential impacts were scoped in as the most relevant for the AoI and the social receptors.

1. Community expectations of the Project
2. Increased local employment, capacity building and supply demand
3. Capacity strain contribution to local public services and facilities
4. Loss of public access and reduced mobility through local paths
5. Reduced access to grazing and pastoral land
6. Increased presence of workers and interaction with local communities
7. Increased presence of security personnel

These will be described below. Increased road traffic will be detailed in the following section as a specific potential impact. Unplanned events are described below.

7.1.7.2 Community expectations of the Project

Local communities and the local economically active population may develop high expectations of the direct or indirect benefits of the Project, specifically regarding the number of work opportunities available. High expectations for jobs for the local communities will need to be continually managed from the early stages to avoid unrealistic Project expectations. The likely size of the workforce was communicated during stakeholder

engagement that took place in March 2020 and will continue through the construction phase. It is proposed that a local hiring plan be developed to maximise employment opportunities for the local communities.

Impact Assessment: Community expectations of the Project				
Impact Nature	Positive		Negative	
	Impact is negative because unmanaged expectations may lead to heightened concerns / conflict with the local community that may ultimately negatively affect the Project's social license to operate.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is both direct and indirect as the Project will be announced and presented both as part of the regulatory process in the AoI and through the Project's own Stakeholder engagement efforts. It is also indirect because local stakeholders may disseminate expectations about the Project before it is formally disclosed. It is, however, reversible with robust stakeholder engagement.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as potential expectations will likely be highest in the lead up to the start of construction works but are not likely to continue beyond that. It is highly unlikely that expectations will be high during the operational phase.			
Impact Extent	Local	Regional	National	
	Given the high-level publicity surrounding the Project, the impact is expected to occur at a regional level in Navoi.			
Impact Magnitude	Negligible	Low	Medium	High
	Navoi and surrounding areas are considered to be industrialised in nature and it is considered that the local communities have an understanding of the employment opportunities created by industrial development. Nevertheless, the high levels of unemployment in the local area may create a heightened sense of expectation that they should benefit as a result of the Project. The impact magnitude is medium at the local level (<5km) but reducing to Low at the regional level.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is low given that local communities and local economically active population are not depending on this Project specifically as their main source of income. However, this impact has the potential to increase unmanaged expectations among the unemployed and more vulnerable groups.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is Low. This is an adverse impact and the ongoing consultation and dissemination of Project information has been included in the accompanying Stakeholder Engagement Plan.. This impact will be continuously managed throughout the construction phase (and ongoing operation phase).			

7.1.7.3 Increased local employment, capacity building and supply demand

As previously mentioned, the Project will employ up to 900 personnel between technicians and low-skilled personnel. Additionally, the Project will positively influence the local and regional economy during construction from the direct procurement and supply of materials and services from companies based in the local and regional area. This includes the procurement of security, construction companies involved in civil works and the interconnection to the existing transmission lines, logistics, machinery, vehicles and from lodging and accommodation services provided to the workforce.

Impact Assessment: Increased local employment, capacity building and supply demand		
Impact Nature	Positive	Negative
	Impact is positive because construction activities will generate economic growth at a local level through the procurement of workforce, services and materials. Experience from similar projects has indicated that whilst local employment is a positive impact arising from	

Impact Assessment: Increased local employment, capacity building and supply demand				
	the project from increased household income, significant adverse impacts can occur if the local recruitment process is not adequately managed.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is both direct and indirect. Individuals and their household members will benefit from increased income and from training and skill development opportunities. Nur Navoi will also pay taxes during the purchase of materials and services and generate indirect economic opportunities as Project suppliers procure materials and services from their own internal supply chain networks. The increased demand for business-to-business services to small-to-medium enterprises (SMEs) will generate increased revenue in the AoI, resulting in higher turnover for the small to medium enterprises involved. The impact is reversible as it will only continue during the construction phase.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as construction works are expected to continue for a period of approximately 9-12 months. Potentially, living standards and training provided can have longer term durations. Experience has shown in similar projects that short-term employment provides an opportunity for households to pay off their debts, invest in the quality of their housing and increase access to education amongst young people.			
Impact Extent	Local	Regional	National	
	The impact is expected to occur at a regional level.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is low because the total capital expenditure incurred during construction is expected to be a small contribution to the annual regional and City economic output. Local hiring could also have a perceptible change in local household living standards.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is low to medium as local communities, the local economically active population, and regionally based SMEs will have different capabilities to adapt to this beneficial impact. It will vary depending upon the overall size of the business or economically active workforce. For some SMEs, their involvement in the Project may result in a significant increase in business turnover during construction. It is essential that the local recruitment process is adequately managed and seen to be transparent, involving the active participation of local and regional stakeholders.			
Impact Significance	Negligible	Minor	Moderate	Major
	The overall impact significance is moderate. This is a beneficial impact and no mitigation is required. No residual impacts are expected to occur. Enhancement measures which could strengthen the positive effects are discussed in Chapter 7.			

7.1.7.4 Capacity strain contribution to local public services and facilities

It is currently preferred that the construction workforce will be provided with hotel and/or residential housing facilities. Current discussions with Khokimyiat suggest adequate accommodation is available in Navoi and surrounding towns and villages. The owners and employees of hotels and accommodation facilities used will, on one hand, directly benefit through increase business revenue and profits (identified in the impact above). On the other hand, there is a potential capacity saturation of the provision of local public services and their facilities, such as health facilities for construction workers. If a workforce camp is proposed it will be designed in accordance with IFC/EBRD guidance and will include provision for required services.

Impact Assessment: Capacity strain contribution to local public services and facilities				
Impact Nature	Positive	Negative		
	Impact is negative (positive aspects are included in the impact above), due to the potential saturation of local services.			
Impact Type	Direct	Indirect	Reversible	Irreversible

Impact Assessment: Capacity strain contribution to local public services and facilities				
	The impact is indirect because the individuals involved, and the local communities, may be impacted differently depending on their dependence to those services and the actual location of the worker accommodation. The adverse impact is reversible.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The majority of the positive and negative impacts are short-term as construction works are expected to continue for a period of approximately 9-12 months. Capacity strain will likely be more perceptible during the construction period.			
Impact Extent	Local	Regional	National	
	The impact will occur at a local level.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Low as the workforce and their families may represent a perceptible change to the communities in the Direct AoI but maybe not for the Indirect AoI and beyond.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is low to medium as the access to public services is relevant to communities to sustain their livelihoods and the local workforce to develop their daily activities. Suspension or delay of services may be harder for some receptors to adapt than others.			
Impact Significance	Negligible	Low	Moderate	Major
	The negative impact is assessed as Low given the local extent. Nonetheless, considering that Medium receptor sensibility could be encountered, this impact will require mitigation measures as if it were a Moderate Significance. Measures are included in the ESMP.			

7.1.7.5 Loss of public access and reduced mobility through local paths

A boundary fence line shall be installed at the start of construction activities to prevent the entry of unauthorised personnel into working areas to maintain public health and safety. From the moment the fences are erected, local people from the Core, Direct and Indirect AoI will lose access to footpaths inside the Project area. This shall result in longer time periods being required to move between locations when the footpaths are generally used. The road to the east and south of the Project area shall continue to be available. Of note, this impact does not relate to potential economic impacts (described in the next impact) or legal land lease aspects, but to the loss of informal mobility access in local paths.

Impact Assessment: Impacts from a loss of public access to footpaths inside the project area				
Impact Nature	Positive	Negative		
	Impact is negative as there will be a loss of access by footpaths into the Project area.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because local people shall no longer be able to access the footpaths to travel. There are existing local paths marked within the site that may be occasionally used as a crossing area. Users will no longer be travelling inside the Project area as access to this land shall be lost.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is considered to be of very long term as the boundary fences shall be in place during both construction and operations. They may be removed as previous land use is reinstated after Project decommissioning.			
Impact Extent	Local	Regional	National	
	The impact will occur at a local level only as the restrictions to land shall most likely impact people from a single farm.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Low as the limited number of people who currently use the dirt tracks will be able to access alternative tracks or roads to reach their destination. Only a single herder was observed walking over the land.			
	Negligible	Low	Medium	High

Impact Assessment: Impacts from a loss of public access to footpaths inside the project area				
Receptor Value / Sensitivity	The impact magnitude is Medium as other roads shall remain available for use and so there are alternative routes available. Local tenant farmer may need to adapt to the new farming area and access route.			
Impact Significance	Negligible	Low	Medium	Major
	The impact is assessed as Low adverse, primarily because the local farm users may present different times to adapt and readjust to their new timings and distances compared to baseline conditions.			

7.1.7.6 Reduced access to grazing and pastoral land

This impact will commence at the start of construction as working areas are fenced off to prevent unauthorised entry inside the site boundary. No impacts to land and livelihoods are expected to occur in relation to the upgrade of existing access roads which will connect the Project area to the main road (M37), as the width of the roads will not be widened.

The change in land use in the Project area may result in change in local livelihoods mainly as a result of the reduction in available grazing area and reduction in income.

- Site clearing and grading will affect farming activities in the area.
- Transportation of waste from the site and materials and equipment by road may disrupt local livelihoods.
- No physical resettlement will be required therefore there is no need to undertake a Resettlement Action Plan.

Within areas where construction works are ongoing, spatial impacts to access to grazing and pastoral land (in contrast to distance and time-altering impacts from the mobility impact above) will occur arising from a loss of access to grazing and pastoral land. According to the results of fieldwork undertaken during March 2020, the land for the Project area is currently being used for pastureland for the grazing of livestock, specifically from Farm B. Whereas the current tenant reports to having been informed of the land change since 2018, alternative land for their economic activities is yet to be procured. Discussions with the local government on alternative land locations are underway. This will be further reviewed in the full ESIA after a new site visit and interviews are undertaken.

Impact Assessment: Reduced access to grazing and pastoral land				
Impact Nature	Positive	Negative		
	Impact is negative as existing land users shall experience a reduction of access to typical livelihood areas due to the restrictions in access to the land within the site boundary. No physical displacement will occur.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because the local farms will no longer be able to access land inside the Project area during the Project life cycle. Resulting impacts are reversible after the Project's decommissioning stage or after an alternative land is procured.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is very long-term as land users will not be able to conduct pastoral activities inside the Project area from the moment fences are installed along the site boundary until the Project is decommissioned. The impact could have less duration after an alternative land is procured. It should be noted that the land leases were modified since 2018 and reportedly, the administrative process to provide the alternative land has not been completed.			
Impact Extent	Local	Regional	National	
	Impacts associated with a loss of access to land will occur amongst the two farms in the Core AoI.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is medium as the impact is perceptible to the local farms and will represent a relevant change to their baseline conditions in terms of local grazing areas.			

Impact Assessment: Reduced access to grazing and pastoral land				
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor's sensitivities may range from Medium to High, depending on their access to alternative land. Farm A is reportedly not using the area for livestock grazing, but Farm B users still depend on it until alternative land is provided. Farm B users are not the leaseholders of the land, and therefore alternative land needs to be registered under the current tenant name instead of the current leaseholder.			
Impact Significance	Negligible	Minor	Moderate	Major
	The impact is assessed as Moderate pre mitigation, on the basis that Farm B has a high reliance on land inside the Project area for livelihood. Post-mitigation assessment may take the impact significance to Moderate if Farm B tenants are engaged to participate in their alternative land provision.			

7.1.7.7 Increased presence of workers and interaction with local communities

Community H&S may be at risk from worker migration and the presence of workers in the Project area, resulting in a potential change in the disease profile of the local population. A more robust social baseline study will expand on communicable disease morbidity, crime incidence and risks of sexual exploitation. Women (including vulnerable young girls) may be particularly at risk from the increased presence of local and migrant men looking for work opportunities near the Project AoI. Interactions with local community members and women has the potential to increase the incidence of communicable diseases.

It is fundamentally important that the Project fully considers the COVID-19 risks as communicable respiratory diseases will most likely be the most significant concern for potential interactions between the workforce and community members. A more thorough process to prevent and minimise exposure to COVID-19 risks will be included in the Full ESIA. Local workers may be exposed to potential COVID-19 risks where they are employed on the the workers' camp. In turn this could result in further spread of COVID-19 back to the local community. A detailed assessment will be undertaken once the EPC has been appointed and their plans can be scrutinised in detail. While the full details of the workers' camp have not been provided yet, the mitigation measures to avoid and reduce risk exposure will be implemented, as detailed in the Interim Advice for IFC Clients on Preventing and Managing Health Risks of COVID-19 in the Workplace (IFC, 2020).

Further to this the ESIA will consider the potential impact on local hospitals and medical facilities in the event of an outbreak of Covid-19 at the worker's accommodation.

Impact Assessment: Increased presence of workers and interaction with local communities				
Impact Nature	Positive		Negative	
	This is an adverse impact because of the potential for people from outside the local area to turn up seeking employment and other types of economic opportunities. The Project workers which will be based at the workers' camp will also be exposed to H&S risks. This may result in an increased risk and exposure to spreading communicable diseases, increased tensions between residents and newcomers, and may result in an increase in the local incidence of crime, in addition to potential surges of COVID-19 risks.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct and indirect because the Project will cause potential local employment that will attract direct and indirect opportunities and other potential worker migration. This is largely reversible once the construction phase is concluded.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as community health and safety risks will be introduced from the start of the construction phase and although there will be residual risks throughout operation of the project, no significant worker migration is expected. Depending upon the type of incident and impact to human health, the duration could be medium-term. Workers' accommodation will further restrict the movement and interaction of workers with local communities outside the site, and the workers' camp will implement COVID-19 prevention measures within its quarters (further detailed in the full ESIA).			
Impact Extent	Local	Regional	National	

	Risks will be generated at a local level within the Direct and Indirect AoI.			
Impact Magnitude	Negligible	Low	**Medium**	High
	The impact magnitude is Medium because the potential for workers to travel outside their accommodation when they are not working and interact with local residents is perceptible to both Direct and Indirect AoI communities. Both residents and workers living in the workers' camp may be exposed to increased health and safety risks.			
Receptor Value / Sensitivity	Negligible	Low	**Medium**	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the actual location of worker accommodation. Whereas Navoi city will have sufficient means to adapt, other localities such as Uzumzor or the Southern Settlement may not have the same resilience to intake a large workforce or prevent their vulnerable groups from this potential increase to community H&S risks. Depending on the workforce composition, vulnerable worker population may be more sensitive to avoiding or treating communicable diseases, and this will have to be identified as a priority during the planning stage.			
Impact Significance	Negligible	Minor	**Moderate**	Major
	The potential impact during construction is considered to be Moderate adverse, pre-mitigation.			

7.1.7.8 Increased presence of security personnel

In addition to the expected workforce, during the construction phase, private security personal shall be used to provide general security at construction working areas to ensure that there is no entry of unauthorised personnel and that construction equipment is safe and secure. There is the potential for security personnel to use excessive force that results in intimidation or even physical damage, acting as a trigger event to further potential conflicts and Human Rights risks.

Impact Assessment: Increased presence of security personnel				
Impact Nature	Positive		**Negative**	
	This is an adverse impact because of the potential use of excessive force or intimidating presence of security guards that may interact with local herders or community members traveling near the Project site.			
Impact Type	**Direct**	Indirect	**Reversible**	Irreversible
	The impact is direct because the Project will employ security personnel as part of its planned activities and to avoid access from local community members to other OHS risks inside the site. It is largely reversible with the proper HR training.			
Impact Duration	**Short-term**	Medium-term	Long-term	Very Long-term
	The impact is short-term as community health and safety risks will be largely limited to the construction phase.			
Impact Extent	**Local**	Regional	National	
	Risks will be generated at a local level within the Core, Direct and Indirect AoI.			
Impact Magnitude	Negligible	Low	**Medium**	High
	The impact magnitude is Medium because the potential for security guards to interact with local community members is a very perceptible change to the baseline conditions of ample passage and access to the site area.			
Receptor Value / Sensitivity	Negligible	Low	**Medium**	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the timing of previous disclosure of Project starting activities.			
Impact Significance	Negligible	Minor	**Moderate**	Major
	The potential impact during construction is considered to be Moderate adverse, pre-mitigation. It is expected that HR training will reduce this to Minor.			

7.1.8 Traffic and Transportation

7.1.8.1 Assessment Methodology

The assessment is based on the use of a number of different types of vehicles used during the construction and operation of the Project. These include:

- Light Goods Vehicles (LGVs) – contractors' vans, minibuses, private cars etc.
- Heavy Goods Vehicles (HGVs) – vehicles with a maximum rigid length of 12 m and a maximum articulated length of 16.5 m.
- Abnormal loads – vehicles over 25 m in length or 3.6 m wide.

7.1.8.2 Guidance

The assessment has been carried out using the IEMA (2003) "Guidelines for the Environmental Assessment of Road Traffic". The guidelines suggest the following thresholds are adopted to assess whether particular links of the network are to be subject to assessment:

- Rule 1 – Include highway links where traffic flows will increase by more than 30 % (or number of HGVs increasing by more than 30 %).
- Rule 2 – Include any other specifically sensitive areas where traffic flows will increase by 10 % or more.

7.1.8.3 Assessment of Effects

The following sections set out the methodology which has been used to determine if the increased traffic flows during the construction phase of the Project are likely to be significant.

Sensitivity Criteria

The sensitivity of roads, their users and settlements along the proposed route has been assessed in accordance with the criteria set out in Table 7-4. The IEMA guidance details that sensitive locations are defined as receptors that are sensitive to traffic including amenities such as hospitals, places of worship, schools and historic buildings.

Table 7-4: Sensitivity Criteria

Sensitivity	Criteria
High	Large rural settlement containing numerous amenities. Traffic management measures in place such as controlled crossings, signalled junctions etc. Minor / unclassified unpaved roads with low traffic flow volumes. These may not be suitable for large HGV vehicles.
Medium	Rural settlement with a number of amenities. Minor traffic management measures in place. Local road (paved / unpaved) suitable for HGV traffic.
Low	Small rural settlement with few local amenities. Minimal traffic management measures in place. Paved road capable of large volumes of HGV traffic.
Negligible	Scattered dwellings with no local amenities. No / little traffic management in place. Highway suitable for all types of vehicles and volumes.

Magnitude of Change Criteria

The magnitude of impact on traffic flow is determined based on criteria set out in the IEMA guidelines. This is set out within Table 7-5 below.

Table 7-5: Magnitude of Change Criteria

Sensitivity		Criteria
Large	Above 90%	Above 90%
Medium	Between 60% and 90%	Between 60% and 90%
Small	Between 30% and 60%	Between 30% and 60%
Negligible	Under 30%	Under 30%

Assessing Level of Effect

Using these definitions, a combined assessment of sensitivity and magnitude has been made to determine the level of the predicted effect on a receptor i.e. Negligible, Minor, Moderate or Major. All direct and indirect impacts causing Moderate or Major effects, as identified within Table 4-3 are considered to be significant.

Where the identified thresholds above are exceeded, the IEMA guidance sets out a list of effects which should be assessed. This includes:

- Accidents and safety.
- Driver delay.
- Pedestrian amenity.
- Severance.
- Air pollution.
- Dust and dirt.
- Ecological effects.
- Hazardous loads.
- Heritage and conservation.
- Noise.
- Pedestrian delay.
- Vibrations.
- Visual effects.

A number of these effects are covered elsewhere in the ESIA and so those considered within this chapter include:

- Accidents and safety.
- Severance.
- Driver delay.
- Pedestrian amenity.
- Pedestrian delay.

Accidents and safety

IEMA guidelines do not recommend the use of thresholds for identifying significance of impacts due to numerous local causation factors involved in personal injury accidents. However, it is recognised that a significant increase

in overall traffic volumes and abnormal loads may raise concerns over road safety. Therefore, measures to address road safety concerns will form a key part of the assessment methodology and development of mitigation options.

Driver delay

Driver delay occurs due to additional traffic present on the road network. IEMA guidelines note that additional delays are only likely to be significant if the traffic on the network is already at, or close to, capacity. Key areas where delays may occur include:

- At the site entrance due to turning of vehicles.
- On the highway passing the site.
- At key intersections along the highway.
- At junctions where the ability to find gaps in the traffic may be reduced, thereby lengthening delays.

Pedestrian amenity

This is broadly defined as the relative pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width / separation from traffic. IEMA guidelines state that this may be significant where traffic is either halved or doubled.

Severance

IEMA guidelines state that severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. The term is used to describe a complex series of factors that separate people from places and other people. Severance can also result from difficulty in crossing a heavily trafficked road. The guidance indicates that severance effects are considered 'slight' in cases that include:

- Pedestrian at-grade crossings on new roads carrying below 8,000 vehicles per day (AADT) (DoT, June 1993); or
- Changes of traffic flow of less than 30% (IEMA, March 1993).

Pedestrian delay

Changes in the volume and composition or speed of traffic on the road network may affect the ability of people to cross roads. In general, increasing traffic volumes will lead to an increase in pedestrian delay. Thresholds are not recommended for use to identify significance of potential effects due to the range of local factors and conditions which can affect delay.

7.1.8.4 Assumptions

It is assumed for the purposes of this assessment (and forecasted levels of traffic) that construction will commence in 2020/2021. Should this not be the case, it is unlikely that the change in forecasted levels of traffic will be of such a level as to change the assessment outcomes. The calculations are also based on a 100 MW (AC) solar plant.

As the details of how road stone and other materials will be supplied are not known at this stage, it is assumed that the routing of all materials will follow the route identified in the section below, thus presuming a "worst-case" scenario.

The construction schedule will be defined by the Project Developer. The assessment is based on an assumed construction phase duration of around nine to 12 months, taking consideration of potential delays in transportation of materials and weather conditions. It is also assumed that the Project will be constructed as one development rather than in a phased approach. The vehicle numbers and personnel requirements have been calculated based on these "worst-case" assumptions.

7.1.8.5 Traffic Generation

The Project will result in additional vehicles travelling to and from the site during construction. These will include heavy goods vehicles (HGVs) and light vehicles. Overall, the total number of vehicles required to travel to and

from site is not expected to be significant. A worst-case scenario has been modelled where all materials are transported to site by road.

The first period of construction will be associated with the delivery of equipment to site and the construction activities that will be carried out on site. The second phase will involve set up and commissioning of all infrastructure and as such, this stage will have reduced vehicle requirements.

The construction phase is expected to generate the traffic volumes detailed in Table 7-6 below. It should be noted that these traffic volumes are based on previous solar PV project experience and are to be confirmed once a construction strategy is available from the Project Developer. This assessment is limited to the expected amount of HGV movements and construction staff transportation requirements. It is also likely that a larger bus would be provided for construction workers thereby reducing the number of vehicle movements.

Table 7-6: Potential Volume of Vehicle Movements during Construction

Vehicle Type	Activity	Total Vehicle Movements
HGV	Delivery of materials, plant, containers, concrete, aggregate material and welfare facilities	6,030
LGV (people carrier up to 6 people)	Transportation for construction workers to site.	1,400

It should be noted that this does not include movements of any abnormal loads or specialist vehicles (bulldozers, cranes etc) to the Project site. The amount of construction workers being transported to site is based on a typical on-site presence of 20 staff at any one time with an average temporary presence of around 50 workers needed for the installation of the modules.

Construction times can be arranged to avoid local peak times and routing arrangements, particularly for HGVs to minimise potential impacts

7.1.8.6 Effects on the Road Network

The magnitude of change in traffic numbers cannot be quantified accurately at this stage for the majority of the roads due to the lack of traffic count data for the affected roads along the route. Due to the size of the Project however and the length of the construction period, the construction traffic on a daily basis is unlikely to be significant.

It is envisaged that the magnitude of change associated with Project generated traffic would likely to be Low.

Considering that the majority of the road network is of low sensitivity and the likelihood that the magnitude of change would not exceed Low, the overall level of effect is predicted to be Negligible during the construction process.

The impact on the local road network is therefore not anticipated to be significant during construction. Mitigation measures have been proposed to ensure that any impacts are limited.

Impact Assessment: Impacts on traffic during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased traffic volumes.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase construction traffic.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	

Impact Assessment: Impacts on traffic during construction					
	The impact is expected to occur within the site and on national roads in both Uzbekistan and Kazakhstan.				
Receptor Value / Sensitivity	Low	Medium	High		
	Although the transportation route passes a number of towns, the road is likely to have existing HGV traffic and the receptor sensitivity is determined to be low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Low as the increased number of HGV movements is not expected to exceed 30% above baseline.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Negligible and not significant pre mitigation. Although no specific mitigation is required, standard good construction practice will be maintained to ensure no increase in predicted impacts during construction.				

7.2 Operational Phase Impacts

7.2.1 Landscape and Visual Impact

The Project will cover approximately 300 hectares of land and has the potential to change the current agricultural/residential setting. Within the wider area of similar landscape type the project footprint represents <1% of the total land area.

The main consideration is whether the Project is visible from nearby receptors and that visibility of the project will result in a detrimental impact to local businesses, households or tourist areas. The main receptors which would experience views of the project are the local residential properties to the south and east of the project site.

There are a number of ways in which the visual impact of the Project can be reduced. For example, vegetation around the Project that may not directly affect its performance should be left in place or rehabilitated.

Impact Assessment: Landscape and visual impacts during operation					
Impact Nature	Positive				**Negative**
	The introduction of large-scale infrastructure has potential for impacts that would be perceived by some as being detrimental.				
Impact Type	**Direct**			**Indirect**	
	Impacts can be direct (the introduction of the Project changes the landscape itself) or indirect (when the Project affects views from other adjacent or more distant landscapes).				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	**Permanent**
	The impact will persist throughout operation and is therefore considered permanent.				
Impact Extent	**Local**		Regional	National	
	Given the low height of solar arrays (approximately 2.4 m) and the screening offered by surrounding topography (particularly to the east) and vegetation, potentially significant effects will generally be restricted to the local area.				
Receptor Value / Sensitivity	**Low**	Medium	High		
	The local landscape is already altered due to the presence of man-made structures such as overhead power lines, main highway, existing electricity substation and other commercial structures. Sensitivity is also reduced by anthropogenically altered watercourses. However receptors in proximity to the site are predominately related to residential settlement and include a mosque to the south of the Project site, with some associated importance of view toward the predominately rural nature of the Project site. Sensitivity is considered Low.				
Impact Magnitude	No change	Negligible	**Low**	Medium	High
	The magnitude of change is assessed to be Low as the Project will introduce a notable change to the landscape, particular to receptors in closest proximity to the Project site but this will be on a very localised level.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the effect is assessment as Low and not significant.				

7.2.2 Hydrology and Hydrogeology

Potential impacts to surface waters by operating activities would include pollution, increased runoff and erosion, primarily in existing or new erosion channels that receive run-off from roads. Due to the location of the wetlands (used by local communities) to the north and south of the site however, and the sensitivity of these wetlands to an increase in suspended solids from erosion of surrounding ground surfaces, the sensitivity of surface water is considered to be high.

The magnitude of the effect is predicted to be low given the limited area of the Project site in relation to the overall catchment area. As a result, the significance of the impact is assessed as moderate and significant. A number of mitigation measures have therefore been proposed to protect surface water resources.

The Project is not intending to use groundwater for operational activities and therefore there is no likely impact to groundwater availability.

Potential sources of pollution to groundwater during operation include sanitary waste and leaks and spills from maintenance activities. The sanitary waste from employees will be treated using wastewater recycling equipment installed at the control centre. Recycled water will be used to water restored areas of any grassland and landscaping.

Impact Assessment: Hydrology and hydrogeology impacts during operation					
Impact Nature	Positive				Negative
	Impacts on surface water would include increased runoff and erosion, primarily in existing or new erosion channels that receive run-off from roads. Surface and ground water are also at risk of pollution from solid, liquid and hazardous wastes and leaks and spills from maintenance activities.				
Impact Type	Direct				Indirect
	Pollution due to increased run-off, leaks, spillages and waste mismanagement are all considered to be indirect effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact will persist throughout operation and is therefore considered permanent.				
Impact Extent	Local		Regional	National	
	Impacts anticipated to be limited to the local area, primarily adjacent wetland areas and local communities.				
Receptor Value / Sensitivity	Low		Medium		High
	Due to the location of the irrigation canals (used by local communities) to the east and west of the site, and the sensitivity of these canals to pollution and increase in suspended solids from erosion of surrounding ground surfaces, the sensitivity of surface water is considered to be Medium. Sensitivity of groundwater is assessed as medium, recognising the fact that local communities do not abstract groundwater.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect in relation to surface water is predicted to be low given The magnitude of the effect is predicted to be very low, given that the soil and superficial deposits present in the area are expected to provide protection to the groundwater in the crystalline basement rock, and that the use/handling of chemicals /oils/wastewater during operation will be limited. The sensitivity of groundwater is assessed as medium however, recognising the fact that local communities abstract groundwater from boreholes located in surrounding villages. The overall impact is therefore considered to be minor and not significant.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact in relation to surface water is assessed as Medium and significant. Pre-mitigation, the impact in relation to groundwater is assessed as Low and not significant.				

7.2.3 Biodiversity

7.2.3.1 Avifauna

Potential impacts during operation of the Project are as follows:

- Habitat loss and displacement including potential loss of stopover sites for migrating birds.
- Disturbance of birds from people and traffic.
- Loss of birds from electrocution from perching on transmission lines.
- Bird collision with power lines.

The habitat and species composition on the Project site are not deemed to be particularly sensitive or of conservation concern. The Project site is characterised by a high level of anthropogenic disturbance. There is, however, the potential that species of conservation concern could frequent the region, as the project footprint falls within their known distributions.

Impact Assessment: Ornithology impacts during operation					
Impact Nature	Positive				Negative
	Potential impacts during operation of the Project are as follows: Habitat loss and displacement. Disturbance of birds from people and traffic. Loss of birds from electrocution from perching on transmission lines. Bird collision with power lines.				
Impact Type	Direct			Indirect	
	The impacts listed above are all considered to be direct effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional	National	
	The extent of potential impacts includes the Project footprint and the length of the proposed new section of 220 kV overhead electricity line from the Project to the grid connection point.				
Receptor Value / Sensitivity	Low		Medium	High	
	The habitat and species composition on the Project site are not deemed to be particularly sensitive or of conservation concern. However, there is potential for species of conservation concern to be present in the region, as the Project footprint falls within their known distributions. The value of the receptor is considered to be Low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The Project site is already characterised by a high level of anthropogenic disturbance.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Negligible and not significant.				

7.2.3.2 Terrestrial Ecology

Given the lack of mammals of conservation concern, the sensitivity of the Project site is assessed to be low. Furthermore, the degraded nature of the site will reduce the magnitude of the impact to low. This results in a low impact (not significant) which does not require to be mitigated.

Impact Assessment: Terrestrial ecology impacts during operation					
Impact Nature	Positive			Negative	
	Disturbance of fauna from presence of people, machinery, traffic, and noise, primarily within the Project area.				
Impact Type	Direct			Indirect	
	These are indirect impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional	National	
	The impacts on terrestrial ecology are primarily limited to the footprint of the Project.				
Receptor Value / Sensitivity	Low		Medium	High	
	The abundance and diversity of terrestrial fauna was found to be low. A single species of conservation concern was recorded: Central Asian tortoise (IUCN VU). However, there is no reasonable likelihood that the tortoise population occurring within the Project site is of regional importance. The sensitivity of the terrestrial habitat has been precautionary assigned as Medium and this assessment is based on the IUCN (VU) status of Central Asian tortoise. Other plant and animal species recorded during the AECOM are not of conservation concern however this will be confirmed following the further ecological surveys which are programmed for late June 2020.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The area is degraded due to existing anthropogenic activity within the region. In addition, during operation there will be very limited personnel and vehicle movements within the site.				
	None	Negligible	Low	Medium	High

Impact Assessment: Terrestrial ecology impacts during operation	
Impact Significance	The impact is assessed as Negligible and insignificant.

7.2.4 Geology and Soils

During this phase of the Project, the main impacts on soils would be from continued vehicle traffic. Vehicle movements will comprise:

- Movement of staff and materials to and from the site along the access roads.
- Movements between the control centre and across the site for operation and maintenance. Workers are expected to visit the site at least once per week for routine maintenance.

There should be no need for vehicles to travel off the improved roads, and this should be actively discouraged. As described with regard to the construction phase impacts, the main risk to soils would be where vehicles leave prepared roads and drive cross-country. If designated roads are not used, vehicle movements can cause damage over a wide area.

Impact Assessment: Impacts on soil quality during operation					
Impact Nature	Positive				Negative
	The main operational impacts on soils would be from continued vehicle traffic. Vehicle movements will comprise: Movement of staff and materials to and from the site along the access roads. Movements between the control centre and across the site for operation and maintenance. Workers are expected to visit the site at least once per week for routine maintenance. Risk of pollution from solid, liquid and hazardous wastes and leaks and spills from maintenance activities.				
Impact Type	Direct				Indirect
	These are indirect impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional	National	
	The impacts on geology and soils are primarily limited to the footprint of the Project.				
Receptor Value / Sensitivity	Low	Medium		High	
	The soils are a medium sensitive receptor given its agricultural use.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect during operation is very low, since there will be much less frequent traffic than during construction, and only occasional use of heavy equipment. In addition, the use/handling of chemicals /oils/wastewater during operation will be limited.				
Impact Significance	None	Negligible	Low	Medium	High
	The impacts are assessed as Negligible and insignificant.				

7.2.5 Archaeology and Cultural Heritage

7.2.5.1 Archaeology and Cultural Heritage Receptors and Receptor Sensitivity

The archaeological sites known from the wider area are considered to be typical of the region. Some have been designated according to local, national or international standards in terms of their outstanding aesthetic, artistic, documentary, environmental, historic, scientific, social, or spiritual value. The assessment of the scientific value of any archaeological sites may change following intrusive investigation and recording work.

Intangible cultural heritage activities are assessed as being of local significance and no particular elements are designated or registered, and consultation has not indicated any associations with particular innovations, technical

or scientific developments, movements or specific individuals of regional or national significance. The Mavlono Orif Deggaroni Complex at Hazora, 5km north of the site, is a spiritually significant focus of pilgrimage associated with the Naqshbandi Sufi order, an active movement of international significance.

Livelihood issues related to traditional land use and land access are addressed in Section 6.7, Socio-economic.

Sensitivity Criteria

Receptor sensitivity is the degree to which a particular receptor is more or less susceptible to a given impact. Receptor sensitivity takes into consideration the receptor's resilience and value.

Receptor resilience or vulnerability describes the ability of the receptor to withstand adverse impacts. It takes into consideration activity-impact-receptor pathways, as well as environmental characteristics that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of 'vulnerable' to 'resilient', with the former more likely to experience significant impacts as a result of a given change.

Receptor value takes into consideration its quality and its importance as represented, for example, by its conservation status, its cultural importance and/ or its economic value. The evaluation of receptor sensitivity employs a qualitative scale of negligible, low, moderate, and high for each of the sensitivity characteristics, resilience and value.

In the absence of any national or international consensus on archaeological impact assessment methods for non-designated resources, the criteria used to determine receptor sensitivity, magnitude, nature and significance of impacts on cultural heritage are based on the International Commission on Monuments and Sites (ICOMOS) 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)[64]. It is acknowledged that it contains much reference to World Heritage, but the assessment tools contained in its appendices are applicable to all cultural heritage assets.

None of the sites or objects have been previously recorded or designated, so there are no assigned national designation rankings to apply. The sensitivity of an archaeological or cultural heritage receptor also reflects how vulnerable or robust a site, monument, artefact, assemblage or complex is to damage or destruction by a number of factors, including:

- Natural conditions, such as erosion, flooding, wave movement and chemical deterioration.
- Environmental conditions, such as faunal and floral impacts.
- Human conditions, such as vandalism or interference, recreational use, vehicular damage.
- Project-related conditions, including construction and operational impacts.

The assessment of heritage value with regard to research agendas is important in establishing the significance and value of archaeological remains. The value of archaeological remains and sensitivity of archaeological sites, monuments and artefact find spots is judged upon the extent of survival, their current condition, rarity, representativeness, the importance of the period to which the remains date, fragility, connection to other monuments (group value), potential to contribute to knowledge, understanding and appreciation, potential for future research, the values assigned by local experts and the extent of documentation enhancing the monuments' value.

Table 7-7 presents the sensitivity criteria specific to the archaeology and cultural heritage study.

Table 7-7 Archaeology and cultural heritage sensitivity criteria

Sensitivity	Criteria
High	Sites of acknowledged international importance inscribed as World Heritage Sites. Individual attributes that convey Outstanding Universal Value. Nationally-designated archaeological monuments, sites, buildings or historic landscapes protected by national laws. Undesignated sites, structures or historic landscapes of demonstrable national value. Assets that can contribute significantly to acknowledged national or international research objectives, whether designated or not.

[64] ICOMOS 2011 [under review] Guidance on heritage impact assessments for Cultural World Heritage Properties. International Council on Monuments and Sites. Paris. Available at: http://openarchive.icomos.org/266 /

Sensitivity	Criteria
	Well or extremely well preserved historic landscapes with considerable or exceptional coherence, time-depth, or other critical factors. Intangible Cultural Heritage inscribed on national registers, or associated with movements or individuals of national or global significance.
Moderate	Designated or undesignated sites, landscapes or seascapes that can contribute significantly to regional research objectives. Designated or historic buildings that have exceptional qualities or historical associations, with important historic integrity and contributing significantly to historic character. Designated or undesignated historic landscapes or seascapes of regional value, which would warrant designation. Intangible cultural heritage areas in local registers, or associated with movements or individuals of local importance.
Low	Designated or undesignated assets of local importance. Assets compromised by poor preservation and/ or poor survival of contextual associations, or with little or no surviving archaeological interest. Assets with potential to contribute to local research objectives. Historic buildings of modest quality in their fabric or historical associations, or buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Undesignated historic landscapes or seascapes with importance to local interest groups, whose value is limited by poor preservation and/ or poor survival of contextual associations. Landscapes or seascapes of little or no significant historical interest. Intangible cultural heritage activities of local significance, or associated with individuals of local importance. Poor survival of physical areas in which activities occur or are associated. Areas with few intangible cultural heritage associations or vestiges surviving.
Negligible	Assets with little or no surviving archaeological interest. Buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Areas with few intangible cultural heritage associations or vestiges surviving.
Unknown	The importance of the resource cannot be ascertained.

Source: ICOMOS, 2011

Receptor Sensitivity

Table 7-8 presents the level of sensitivity for each receptor identified.

Table 7-8 Sensitivity criteria for archaeology and cultural heritage receptors

Receptor	Sensitivity
Tangible cultural heritage: archaeological sites (presently unknown) Assess impacts on any sites identified by State Archaeological Expertise	Unknown – anticipated to be low
Natural features/ tangible objects with cultural values	N/a
Intangible cultural heritage: cultural knowledge, living traditions & religious practices [Scope out Hazora pilgrimage – distant, no impact on access/practices/setting]	N/a
Critical Cultural Heritage: Assess impacts on TL WHS Silk Roads [large linear site, no impact on fabric, existing impacts on setting from modern infrastructure along course of M37] Assess impacts on any State Register sites identified in proximity to site in the course of consultation. [Scope out impacts on TL Rabati Malik Caravanserai, Vobkent Minaret via ZTV] [Scope out Hazora cemetery]	Very High (TL WHS) High (cemetery)

The sensitivity of any currently unknown archaeological remains that may survive within the Project Area cannot be accurately determined at the time of writing. Their sensitivity would be derived from their potential to contribute to our scientific understanding of past human activities and environments. However, based on the likely level of

preservation of remains and the condition of remains from the wider area, it is assessed that their sensitivity would be low.

7.2.5.2 Assessment of Impacts

During the operational phase there will be no new impacts on existing cultural sites. The lack of visibility of the Project from these sites and the absence of a construction workforce will mean that no impact is predicted.

Impact Assessment: Impacts on archaeology and cultural heritage					
Impact Nature	Positive				**Negative**
Impact Type	Direct				**Indirect**
	These are indirect impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	**Permanent**
Impact Extent	**Local**	Regional	National		
	The impacts on archaeology are primarily limited to the footprint of the Project.				
Receptor Value / Sensitivity	Low	**Medium**	High		
	No works will be taking place other that maintenance and security. There are a number of sites within 30km of the Project of cultural importance.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	No impacts are predicted.				
Impact Significance	None	**Negligible**	Low	Medium	High
	The impacts are assessed as Negligible and insignificant.				

7.2.6 Noise

General EHS Guidelines sets out noise limits for industrial areas, commercial areas, residential areas and construction. The relevant limit is therefore shown as the residential limit of 45dB(A) for night time. At levels above these criteria the noise emissions from the Project would be considered to have a significant effect.

Solar PV panels themselves do not provide a noise source during operation, however equipment within the site (typically inverter stations and transformers) will emit noise during operation. While the Project will only be operational during daylight hours, as the transformers are permanently energised, they may emit some noise by way of magnetostriction hum during night-time. The distance between the substation transformers and the nearest residential properties is approximately 1 km.

For the purposes of this assessment it is assumed that the substation transformer is the dominant source of noise as the other sources (transformer and invertor stations) are over 200 m from the closest receptor. For the purposes of the assessment the following details have been assumed.

The substation power transformer (oil natural, air natural or ONAN) sound pressure level is 65 dB(A) at 1 m from a L x W x H: 5500 x 3600 x 4900 mm transformer.

The substation transformer is located approximately 1 km from the closest receptor.

The sound pressure level is assumed as without forced cooling as oil natural, air natural or ONAN cooled. Should cooling fans be required (oil natural, air forced or ONAF) the sound pressure level would increase, and a revised assessment will be required.

The assessment is based on the above details and distances to closest receptor. Should the sound pressure level increase, or the detailed design process revise locations or dimensions of infrastructure within the site, a revised assessment would be required.

The relevant calculation is presented below.

Assuming a clean 50 Hz supply, the critical frequency will be in the 125 Hz octave band.

At 75 m distance, the attenuation, according to ISO 9613-2, with worst-case assumptions of temperature and humidity, and assuming hard ground (ground absorption G = 0) at source and receiver and semi-soft (G = 0.5) in between, is 45.5 dB ref 20 µPa/pW.

Assuming the sound power level of the substation power transformer is 65 dB(A), the sound pressure level at 75 m will be 19.5 dB(A).

The (oil natural, air natural or ONAN) sound pressure level is 65 dB(A) at 1 m from a L x W x H: 5500 x 3600 x 4900 mm transformer, then the sound power level, according to IEC 60076-10, is 65 + 10log10((4.9 + 1)*2(5.5 +2 + 3.6 + 2)) = 86.9 dB(A), leading to a sound pressure level at 75 m of 41.4 dB(A).

No breach of the lower 45 dB limit is therefore identified.

Impact Assessment: Noise impacts during operation						
Impact Nature	Positive				Negative	
	Solar PV panels themselves do not provide a noise source, however equipment within the site (typically inverter stations and transformers) will emit noise during operation. While the Project will only be operational during daylight hours, as the transformers are permanently energised, they may emit some noise by way of magnetostriction hum during night-time.					
Impact Type	Direct				Indirect	
	Noise received at nearby receptors would be considered a direct impact of the operation of the Project.					
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent	
	The impacts will persist throughout operation and are therefore considered permanent.					
Impact Extent	Local		Regional	National		
	Operational noise impacts will be restricted to an area immediately adjacent to the Project.					
Receptor Value / Sensitivity	Low		Medium	High		
	There are settlements in relatively close proximity to the Project, receptors are of high sensitivity.					
Impact Magnitude	No change	Negligible	Low	Medium	High	
	The distance between the transformers and the nearest residential properties is considered sufficient to reduce any noise to an acceptable level, however the substation is located to the south of the site boundary in close proximity to receptors. Noise calculations have deemed operational noise to be within specified limits. A Very Low magnitude of change is therefore predicted.					
Impact Significance	None	Negligible	Low	Medium	High	
	The impact is assessed as Minor and not significant.					

7.2.7 Glare and Glint

The potential for glare and glint from the Project during operation is low. It is important to note that the PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. The PV panels that will be used for the Project have very limited levels of either glint or glare and are substantially less reflective than most surfaces such as still water, glass or steel. Glint will be substantially reduced by the anti-reflective coating of the modules that is incorporated to maximise the light capture of the solar cells.

Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation.[65]

[65] Federal Aviation Administration (FAA), July 2015. Final Report: Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach.

Impact Assessment: Glint and glare impacts during operation					
Impact Nature	Positive				Negative
	There is a perception that solar PV panels (in a similar way to glass buildings and large metal structures) can cause significant solar reflections that can cause a distraction or nuisance. This can be an important concern for airports and highways particularly when located in the pilot's direct field of vision on approach to the runway.				
Impact Type	Direct				Indirect
	This is a direct impact resulting from sunlight reflecting off the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	Any glint and glare issues would persist throughout operation.				
Impact Extent	Local		Regional	National	
	Any impacts would be limited to areas in relatively close proximity to the site.				
Receptor Value / Sensitivity	Low		Medium		High
	There are obvious safety concerns with regard to any potential to distract aircraft pilots and vehicle drivers, causing accidents leading to potential injuries or deaths.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Minor and not significant.				

7.2.8 Social Impacts

Potential impacts during operation of the Project are largely similar to the Construction phase, with reduced impact Magnitudes and Significance.

The following potential impacts for the operation phase were considered as the most relevant for the AoI and the social receptors.

1. Unmet Project expectations
2. Increased local employment, capacity building and supply demand
3. Loss of public access and reduced mobility through local paths
4. Reduced access to grazing and pastoral land
5. Increased presence of security personnel

These will be further described in the Full ESIA.

7.2.8.1 Occupational Health and Safety During Operation

During the operational phase, there may be occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. Key risks could include (amongst others), collision with vehicles and plant and exposure to a variety of hazards such as electric shock from exposed cables and thermal burn hazards and exposure to chemicals, hazardous or flammable materials.

Occupational health and safety impacts are considered of long-term duration throughout the operational phase and are expected to be of medium magnitude and medium sensitivity as in extreme cases they could entail permanent impacts (e.g. permanent disability). As such, the impacts are considered to be of major impact and appropriate mitigation has been proposed.

Impact Assessment: Occupational health and safety impacts during operation					
Impact Nature	Positive				Negative
	There will be some occupational health and safety risks through carrying out operational and maintenance activities. This includes risk of electrocution, thermal burn hazards, exposure to hazardous chemicals and working in extreme temperatures. Mismanagement of wastes (such as domestic solid waste, sewage and hazardous wastes) can also represent a health and safety risk to workers, such as disease, injury or death.				
Impact Type	Direct				Indirect
	The risks are predominantly associated with direct impacts on the operational and maintenance workers due to the operation of the Project. Health and safety risks associated with waste mismanagement are considered in-direct impacts.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional	National	
	The impacts will be limited to the local area.				
Receptor Value / Sensitivity	Low		Medium		High
	The receptors in this case are the workers. Although there will be few personnel involved in the operational and maintenance activities, each individual is of high value/sensitivity.				
Impact Magnitude	No change	Very Low	Low	Medium	High
	Occupational health and safety impacts could result in disease, injury or death to workers and so the magnitude is high.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact is assessed as Major and significant.				

7.2.8.2 Impacts on land and livelihoods from land occupied by the project area

Impacts to land and livelihoods will commence at the start of construction as working areas are fenced off to prevent unauthorised entry inside the site boundary, and continue during the operation of the Site. The land for the project area is currently being used for livestock grazing.

Impact Assessment: Impacts on land and livelihoods from land occupied by the project area					
Impact Nature	Positive			Negative	
	Impact is negative as existing land users shall experience a loss of livelihood (economic displacement) due to the restrictions in access to the land within the site boundary. No physical displacement will occur.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is direct because land users will no longer be able to access land inside the Project area. Indirect impacts may also occur due to the way in which greater pressure on land resources outside of the project area may occur from people who are using land inside. Although some of the resulting impacts are reversible, others are not reversible as there will be a permanent loss of access to land resources.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent as land users will no longer be able to graze livestock inside the project area from the moment fences are installed along the site boundary. However, the Project will ensure that alternative land is available and will provide resources to help the PAH establish grazing on the new piece of land. As a result, the impact is expected to be felt in the short-term.				
Impact Extent	Local		Regional	National	
	Direct and indirect impacts associated with a loss of access to land will occur amongst two PAHs.				
Impact Magnitude	Negligible	Low	Medium	High	
	The impact magnitude is medium as the number of PAHs currently identified from a government survey team is 2, who reside in close proximity to the project site. Based upon				

Impact Assessment: Impacts on land and livelihoods from land occupied by the project area				
	a national average of 4.6 – 5.9 people per household (urban-rural) as the national average,[66] the number of Project Affected People (PAPs) could comprise up to 12 depending upon the composition of the two households. Following consultation with the Khokiyiat and one PAH in March 2020 it was considered that only a single PAH would be affected as the second PAH has revoked their lease and is farming on a reduced area that continues to meet their needs.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is high. The PAH rely on land inside the project area for their income by grazing livestock. There is the potential for the loss of access to land to impact disproportionally upon vulnerable people including small-scale farmers, women, and elderly/young people who are susceptible to any change in their socio-economic conditions.			
Impact Significance	Negligible	Low	Medium	High
	The impact is assessed as Major and significant pre mitigation, on the basis that the remaining PAH has a high reliance on land inside the project area for food security and livelihood. With the completion of the allocation of alternative land the impact significance is expected to reduce to Low			

7.2.8.3 Grazing land for livestock.

AECOM understands from the Proponent that all land users have no recognisable legal right or claim under national law to the land or assets they occupy and currently use. All land is now Government owned.

Impact Assessment: Impacts on land and livelihoods from land occupied by the project area					
Impact Nature	Positive		Negative		
	Impact is negative as existing land users shall experience a loss of livelihood (economic displacement) due to the restrictions in access to the land within the site boundary. No physical displacement will occur.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is direct because land users will no longer be able to access land inside the project area. Indirect impacts may also occur due to the way in which greater pressure on land resources outside of the project area may occur from people who are using land inside. Impacts are not reversible as there will be a permanent loss of access to land resources.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent as land users will no longer be able to graze livestock inside the project area from the moment fences are installed along the site boundary. As noted above, the Project will ensure that alternative land is available and will provide resources to help the PAH establish grazing on the new piece of land. As a result, the impact is expected to be felt in the short-term.				
Impact Extent	Local	Regional	National		
	Direct and indirect impacts associated with a loss of access to land will occur among a single PAH.				
Impact Magnitude	Negligible	Low	Medium	High	
	The impact magnitude is low as the number of PAHs currently identified is 2. Based upon a national average of people per household, the number of Project Affected People (PAPs) could comprise approximately 12 depending upon the composition of the households.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The receptor value is medium. A single PAH relies on land inside the Project area for their household income. There is a risk that the like for like compensation offered to the PAH may not meet their expectations, resulting in frustration and an increase in tension at a local level.				

[66] Government of the Republic of Uzbekistan (2005). Welfare Improvement Strategy Paper of the Republic of Uzbekistan for 2005-2010. Interim PRSP Document (I-WISP)

Impact Assessment: Impacts on land and livelihoods from land occupied by the project area				
Impact Significance	Negligible	Low	**Medium**	High
	The impact is assessed as Major and significant pre mitigation, on the basis that that PAHs have a high reliance on land inside the project area for food security and livelihoods. With the completion of the allocation of alternative land the impact significance is expected to reduce to Low			

7.2.8.4 Impacts from local employment during operation

The number of local people that are to be employed during operation are expected to comprise of a mix of Uzbek nationals working for the Proponent, in addition to personnel provided through local subcontractors to provide a range of supporting services, including security.

As the project transitions from construction into operation, there will be a shift in the skills required. Consequently, it will be necessary to develop the skills of local people during construction so that suitable individuals are able to take up the long-term (potentially 20 years) positions during operations.

The individuals employed and their household members, will benefit from increased income that is likely to increase their overall quality of life and access to healthcare, educational and other types of resources across a longer time frame. The household is also expected to experience increased resilience to external shocks from the supply of income, that could arise from a sudden change in health status or external factor such as food price inflation.

Impact Assessment: Impacts from local employment during operation					
Impact Nature	**Positive**		Negative		
	The impact during operations is positive.				
Impact Type	**Direct**	**Indirect**	**Reversible**	Irreversible	
	The impact is both direct and indirect because the individuals and their household members are expected to benefit from an increase in standard of living and reduced vulnerability to external shocks. The impact is reversible as the income generated from local employment shall cease at the end of their employment at the end of the operational phase (20 years).				
Impact Duration	Temporary	Short-term	Medium-term	**Long-term**	Permanent
	The period of employment will continue over the lifetime of the Project which is 20 years.				
Impact Extent	**Local**		Regional	National	
	The impact will occur at a local level amongst the villages where employees are based.				
Impact Magnitude	Negligible	**Low**	Medium	High	
	The impact magnitude is low as the workforce required during operations is relatively small when compared to the construction stage.				
Receptor Value / Sensitivity	Negligible	Low	Medium	**High**	
	The sensitivity is high as local employment during both construction and operations is a key expectation amongst local villages and their representatives. It is essential that Uzbeks comprise a significant component of the operational workforce.				
Impact Significance	Negligible	Minor	**Moderate**	Major	
	As a result of the above, the overall impact is assessed as moderate and positive. Enhancement measures are discussed in Chapter 7.				

7.2.8.5 Impacts on the national and regional economy during operation

Operation of the Project shall generate up to 100 MW of renewable energy which shall be fed into the national grid. The Proponent shall also make annual tax payments to central government in parallel with the generation of revenue.

During operations, there will also be an ongoing demand for general support from other national and regional businesses, such as consulting, legal, and accounting using small to medium enterprises.

Impact Assessment: Impacts on the national and regional economy during operation				
Impact Nature	Positive		Negative	
	Impact is positive because the operation of the Project will generate energy, which is fed into the national grid, contributing towards the ongoing development of the country which is currently severely lacking in energy generation.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is both direct and indirect because the company will provide energy to the national grid which will benefit other electricity users (households, businesses and government buildings), pay taxes, purchase materials and services which will lead to the growth of small and medium business. The impact is reversible as it will only continue during operation.			
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is long-term because it would continue throughout the whole period of project operation of 20 years.				
Impact Extent	Local	Regional	National		
	The impact will occur at a regional and national level as energy shall be injected into the national grid. The local communities shall not be provided with electricity as this is the responsibility of the offtaker.				
Impact Magnitude	Negligible	Low	Medium	High	
	The impact magnitude is medium as the quantity of energy generated by the project is an important contribution at 100MW.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity is medium as the countries' energy demand shall continue to increase during the lifespan of the project.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The overall impact significance is moderate. Enhancement measures are discussed in Chapter 7.				

7.2.9 Transportation and Access

The main transport impacts will occur during the construction phase. The number of vehicles during operation is likely to be very low, with access required only for maintenance and servicing. The majority of these will be light vehicles and, at the worst case, a HGV trip may be required to transport a replacement transformer to site. The effects of traffic movements stemming from the operational phase are therefore considered Negligible and so insignificant.

7.3 Decommissioning Phase Impacts

Decommissioning impacts are considered to be similar to construction phase impacts. The assessments outlined in Section 7.1 should therefore be referred to. A summary is provided below.

7.3.1.1 Occupational Health and Safety

Decommissioning activities will inevitably expose workers and the public to occupational health and safety risks. These risks will be similar to those at construction. Such impacts are considered to be of short-term duration as they are limited to the decommissioning phase only.

7.3.1.2 Air Pollution

The change in ambient air quality may arise at decommissioning as a result of fugitive dust and particulate matter emissions. However, such impacts are expected to be temporary and of short-term nature as they are limited to the decommissioning phase only. The impacts will similar to the construction phase.

7.3.1.3 Noise

Local noise levels will be affected temporarily by decommissioning activities such as equipment movement during building demolition and use of heavy machinery. The impacts will be similar to those experienced during the construction phase.

7.3.1.4 Hydrology and Hydrogeology

Effects on water resources during decommissioning are likely to be similar to those during construction, so sensitive features such as drainage channels would need to be avoided. Contaminated materials such as oil storage tanks would need to be removed from the site and taken to a suitable disposal site to prevent future contamination of surface and groundwater.

7.3.1.5 Biodiversity

Similar to construction, the main impacts during decommissioning are likely to comprise disturbance to birds. Following decommissioning, reinstatement will be important to re-establishing the ecosystem in areas previously occupied by solar panels, site roads and other structures. At the time of decommissioning, the sensitivity of some species, particularly those which are regionally rare, may have increased.

7.3.1.6 Terrestrial Ecology

Similar to construction, the main impacts during decommissioning are likely to comprise habitat loss, loss of small numbers of mammals, and disturbance to animals. Following decommissioning, reinstatement will be important to re-establishing the ecosystem in areas previously occupied by solar panels, site roads and other structures. At the time of decommissioning, the sensitivity of some species, particularly those animals which are regionally rare, may have increased.

7.3.1.7 Geology and Soils

Similar to construction, soils will be highly vulnerable to traffic and erosion during decommissioning. The movement of materials off-site may involve the construction of temporary roads and use of large vehicles. There is also potential for chemical or oil spills, or the incorrect handling/disposal of wastes during decommissioning. Similar measures to those outlined for the construction phase will need to be taken to minimize impacts on soils. Reinstatement of land and after-care will be critical to mitigating the damage to soils.

The panels and supports will be dismantled and steel and other useful materials will be recycled. Inert materials which cannot be recycled will be taken to a suitable disposal site. However, foundations and other inert belowground materials will be buried. This is not likely to have a significant impact on soils as it will not prevent re-vegetation or restoration of land.

7.3.1.8 Social Impacts

Similar to construction, the use of a workforce and decommissioning activities could potentially generate a variety of health and safety risks to the local residents, due to general site decommissioning activities (removal of site equipment and infrastructure) and the presence of project vehicles on local risks posing a risk to local residents and school children. A Community Health and Safety Plan, Traffic Management Plan and Emergency Response Plan will be in place for the decommissioning phase of the Project.

7.3.1.9 Transportation and Access

Decommissioning effects are likely to be similar to that during construction although reduced in magnitude. At this stage, it is not possible to quantify the traffic effect during decommissioning of the Project as it is considered to be too far in the future to estimate any baseline traffic flows. It is unlikely however to present any significant effects.

8. Mitigation and Enhancement Measures

The proposed mitigation measures outlined below will be further developed during the ESIA process. Those outlined below are anticipated to be required for the Project based on the information available to date and have been developed in line with IFC Performance Standards and Guidance.

8.1 Landscape and Visual

8.1.1 Design Phase

Landscape and visual mitigation for the Project will be embedded in the design of the solar farm and will largely centre around the selection of a layout which minimise the potential for significant impacts whilst achieving operational objectives. If necessary, further mitigation is available in the form of screening.

8.1.2 Construction Phase

The best form of mitigation for landscape and visual impacts arising from construction is related to conservation of soils and vegetation. Measures include:

- Limiting damage to any grassland by keeping the construction areas and roads to a minimum and maintaining strict requirements for vehicles to remain on the roads at all times.
- Reinstating grassland where construction areas and roads are no longer required. This would reduce the duration of the visual impact.

Mitigation to reduce the adverse impact resulting from litter and rubbish (plastic bags, bottles etc.) include:

- Provision of adequate facilities for the disposal of rubbish.
- Training of the workforce in waste management.
- Reduce the amount of waste to the maximum extent possible.
- Collect all solid waste and store until transported to an appropriate waste disposal facility and disposed.
- Organization of clean-ups for existing rubbish.

8.1.3 Operational Phase

There are a number of ways in which the visual impact of the Project can be reduced. For example, mitigation options include the development of a landscape and planting scheme to provide further screening. The planting scheme would be developed prior to the operational phase of the Project and implemented in the first available planting season following the completion of construction. It is noted that vegetation is limited within the site area and a planting scheme may not be feasible.

Vegetation around the Project that may not directly affect its performance should be left in place or rehabilitated.

It is likely that there will be limited visual impacts due to the distance from local communities. This will be fully assessed at the ESIA stage.

8.2 Flora and Fauna

8.2.1 Pre-Construction / Site Clearance

The first stage of mitigation should ensure that the Project site is prepared in such a way as to discourage animals from using the Project area. Initial site preparation and clearance could result in the loss of nesting birds and any other breeding species and where possible the initial preparatory work will be undertaken during the non-breeding season. However, it is recognised that the project schedule is linked to the long stop dates offered by the offtaker meaning that the Project is not able to commit to this mitigation option. If possible, the aim of this work is to make the areas of roads and hardstandings unsuitable for species (e.g. ground nesting birds), minimising the likelihood of impact.

A pre-construction survey should be completed for works undertaken in the breeding season to check for animals (reptiles and active bird nests) and, if species of conservation importance are identified, appropriate measures

will be taken. It is noted that construction works are scheduled to take place from September 2020 onwards, outside the breeding season. As a result, no such surveys are anticipated.

All areas to be cleared should be precisely demarcated and work carried out only within those areas. Appropriate training will be provided to workers regarding the identification of wildlife in the instance of chance encounters during site clearance.

There is no wood available from felled trees during bush clearing operations which could be used as fuel wood rather than felling additional trees as a fuel source.

Any areas outside of the footprint of the Project, that are cleared as a result of construction activities (storage areas etc.) should be rehabilitated following the completion of construction phase.

Potential invasive flora species should be identified, and action must be taken to clear these species if they occur in or around areas designated for bush clearance to prevent establishment after clearing.

8.2.2 Construction Phase

Likely mitigation during construction includes the following measures:

- Project staff require environmental toolbox talks during construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna.
- Destructive searches for reptiles (including Central Asian tortoise) should be undertaken during site clearance under the supervision of a suitably experienced ecologist. Destructive searches for reptiles and amphibians involve the careful removal of turf and 100mm of topsoil in potentially suitable habitats.
- Staff should be briefed on risks of exposure to scorpions, spiders and snakes as well as the preventative measures. Workers in the field should wear protective clothing; long trousers, closed shoes and leather gloves. Information regarding nearest location of treatment for any bites and stings should be made available.
- Any snakes encountered at the site must not be handled or harmed by Project workers. Animals must be relocated by appointed personnel.
- Any fauna / avifauna directly threatened by construction activities should be relocated by relevant personnel.
- The collection, harvesting or hunting of any plants or animals must be strictly prohibited. A ‘no tolerance’ policy must be adopted with respect to construction and operations workers. Any culprits guilty of poaching must be apprehended. They must be immediately dismissed from their position and handed over to Wildlife authorities.
- Fires must be controlled and only allowed in fire permitted areas. Staff training must be carried out in relation to fire safety and firefighting equipment such as fire extinguishers and sand buckets available at every site.
- The collection or hunting of any birds must be strictly prohibited.
- Cleared areas no longer required for construction activities should be rehabilitated by reseeding with locally found grasses and shrubs increase soil stability.
- Construction vehicles must remain on the access roads and not drive in the un-cleared bush.
- Drivers operating in the area must be well briefed and must be aware of the dangers that vehicles pose to the local fauna.

8.2.3 Operational Phase

Operational mitigation measures are set out below:

- During routine maintenance any invasive flora species should be removed.
- Monitor bird collisions with the solar panels and overhead lines.

- Anti-collision marking devices must be added along the entire length of the power line in the designated areas.
- Tower designs for the power lines (220kV and below) must place live and earth phases at least 1.8m apart from each other.
- It is recommended that bird perches be fixed on top of the tower structures.
- Consideration should be given to the incorporation of permanent tortoise openings during the design of the boundary fencing, with the purpose of allowing the movement of Central Asian tortoise between the Project Site and the wider AOI. This species will be the focus of a monitoring programme during the operational phase with the purpose of assessing the population within and immediately adjacent the operational Project Site.
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8.3 Hydrology and Hydrogeology

8.3.1 Site Preparation

To reduce the potential for erosion of drainage channels during road construction, routes should be selected to avoid ephemeral drainage channels where possible. Culverts or other drainage control features should be installed where crossings of drainage routes are unavoidable. Stormwater run-off onto roads and uncontrolled flow from roads should be minimized.

8.3.2 Construction Phase

The risk of contamination through temporary storage facilities should be reduced through the storage of all materials within designated areas. Supplies should also be provided for the clean-up of minor spills. A Pollution Prevention Plan should be drawn up to prevent accidental spillage of fuels, chemicals or other substances.

To reduce the risk of soil and water pollution from leaks and spills through storage of oil it is recommended that:

- A designated storage area is established with an impervious base and impermeable bund walls. Capacity must be sufficient to contain the full volume within a bund and secured area.
- All fuel, oil and chemical storage is stored in a designated secure area.
- Hoses and valves are checked regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Diesel pumps and similar items are placed on drip trays to collect minor spillages. Trays should be checked regularly and accumulated oil removed.

With regards to potential impacts associated with the construction workforce, it is proposed that sanitary waste is collected in containers below portable toilets and transported for disposal. The waste will be disposed at a location to be agreed with Local Government respective officer or environmental officer.

8.3.3 Operational Phase

The potential for soils and groundwater contamination associated with waste disposal should be reduced through the reduction of wastes to the extent possible whilst maximising the re-use and recycling of materials. All waste and rubbish should be collected and stored before disposal in at a location to be agreed with the Khokimiyat respective officer or environmental officer.

A full Water Resource and Management Plan will be developed prior to the commencement of operations at the Project site. This will include an assessment of panel cleaning requirements and methods, including the consideration of alternative waterless cleaning methods, etc.

Mitigation measures associated with maintenance and use of oils and other chemicals include:

- Establish a designated storage area with an impervious base and impermeable bund walls and protected from precipitation. Capacity must be sufficient to contain the full volume within a bund and secured area.
- Store all fuel, oil and chemical storage in the designated secure area.

- Do not leave vehicle unattended during refuelling, never leave open a delivery valve.
- Check hoses and valves regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Place diesel pumps and similar on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil.

8.4 Geology and Soils

8.4.1 Site Preparation

To reduce damage to soils and risks of soil erosion, the length and width of the on-site and off-site roads should be optimized to reduce the need for cut-and-fill material. Run-off and erosion control features should be included in all civil designs by the Project Developer.

Design parameters for foundations, access roads and drainage constructed at the site will need to be developed to account for erosion. These design parameters are required to be adhered to by the contractor to reduce the potential impacts detailed above.

8.4.2 Construction Phase

8.4.2.1 Soil strength and foundations

It was noted that it is not advisable to rely on the strength of the soil to support any foundation but to go through it and lay foundations on underlying sandy and gravelly layers.

Two main options are:

- Replace Sandy Silt Unit with filler material, and lay foundations on it. The thickness to be replaced should be that of the unit, and the refill should extend under any foundation with a width of at least 1 meter.
- Drive piles through the Sandy Silt Unit to the underlying Sandy Gravel Unit and Silty Sand Unit and transmit loads on these.

8.4.2.2 Trenches and earthworks

Some trenches for laying electric wires, pipes, etc are expected to be dug on site. Additionally, levelling will be needed to lay all facilities.

Up to a depth 1 metre, temporary trenches and levelling talus can be excavated with steep slopes (1H:5V) but preserving the stability of loose top soil with gentle 3H:2V in the superficial 0.3 meters.

Permanent slopes will go down to 1H:1V, keeping superficial 0.3 meters at 3H:2V.

If excavation depth is above 1.0 meter, the slope has to decrease accordingly, due to the presence of loose soil. Temporary slopes (for example in trenches) will be no steeper than 1H:1V (keeping superficial 0.3 meters at 3H:2V), while permanent ones will go to 3H:2V in their entire height.

Regarding paved or unpaved roads on the plot, problems arise because of collapsible soils. As unforced collapse can happen as previously explained, to ensure the stability of roads it would be necessary to replace the ground under the road layout (as previously explained for shallow foundations), to support the road surface by means of piles, mortar column type, or to improve the ground under the road by means of mortar injection or similar. All mortar would be sulphate resistant.

8.4.2.3 General

Other general mitigation measures to be applied during construction include the following:

- Clearly demarcate storage and staging areas and store all materials, equipment and vehicles in demarcated area to reduce soil damage. Furthermore, vehicles should be confined to demarcated roadways.

- Establish native grasses in erosion control channels and in other areas immediately after final disturbance.
- Salvage and store topsoil and subsoil before areas are excavated, with topsoil stripped and stockpiled separately.
- Segregate excavated soils into stockpiles dependant on material type and provide erosion control while stockpiled.
- On completion of earthworks, backfill material in the same stratigraphic sequence.
- If narrowing access roads following construction, scarify compacted areas and establish native grasses.
- Once construction and road-building are complete, scarify all areas compacted by off-road vehicle / equipment movements and establish native grasses.
- Store all materials within designated areas of temporary storage facilities and provide supplies to clean-up of minor spills.
- Confine all vehicles and equipment to the roadway and, to extent possible, minimize activities during wet conditions. When activities must occur in wet conditions, control storm water by using fabric, straw bales or other measures to impede storm water flow and prevent erosion.
- When damage to wet soil occurs, repair once dry conditions return.
- For storage of oil, establish a designated storage area, with impervious base and impermeable bund walls. Capacity must be sufficient to contain full volume within a bund and secured area.
- Store all fuel, oil and chemical storage in the designated storage area.
- Check hoses and valves regularly for signs of wear and ensure they are turned off and securely locked when not in use.
- Place diesel pumps and similar items on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil.
- Reduce the amount of waste to the maximum extent possible.
- Collect all solid waste and store until transported to the designated disposal site.

8.4.3 Operational Phase

8.4.3.1 Seismicity

The EPC contractor should comply with best international design and construction practices, compatible with the seismic loads. In addition, the EPC should comply with the relevant Uzbekistan design codes.

8.4.3.2 General

Several measures are recommended during operation of the Project to reduce damage to soils. These include:

- Confine all vehicles to roadways.
- Monitor road condition regularly; then repair damaged and rutted roads rather than bypassing damaged sections.
- Monitor erosion controls and repair as needed.
- Where possible, maintain grass cover on berms and ditches.
- Prohibit use of vehicles and equipment off prepared roads.
- Re-stabilize existing eroded tracks and restore grass cover as needed.
- Do not collect firewood from the site.
- Reduce wastes to the extent possible and maximise re-use and recycling of materials. Collect and store all waste and garbage before disposal at the designated site.

- Clean up and store oily and chemical waste and contaminated material before transport to the designated disposal site to reduce risk of soil and groundwater contamination.
- Establish a designated storage area with an impervious base and impermeable bund walls and protected from precipitation. Capacity must be sufficient to contain full volume within a bund and secured area.
- Store all fuel, oil and chemical storage in the designated secure area.

8.5 Noise

8.5.1 Construction Phase

In order to reduce the impact of noise during construction, best practicable means will be followed to ensure that the quietest available plant and construction techniques will be used in order to limit noise output as far as practically possible. The initial noise assessment has concentrated on the two farms located in close proximity to the project site. The larger settlements at Uzumzor to the east and the small settlement located at Hazara Degaron Masjidi to the south are of sufficient distance from the site to ensure that construction impacts are not likely to be significant. AECOM anticipate that the highest magnitude noise impacts will be experienced during piling operations.

Construction will generally be undertaken during normal working hours although some works may be required outside of this time. Where appropriate, micro siting will be undertaken to ensure construction noise impacts are minimised and equipment is located as far as possible from Noise Sensitive Receptors (NSRs). Mitigation measures will also include the use of a sufficient buffer between the Project and local properties to reduce noise to an acceptable level at those locations.

In addition, Project construction traffic routing through community areas will be minimised wherever possible.

8.5.2 Operational Phase

The initial noise assessment has concentrated on the two farms located in close proximity to the project site. The larger settlements at Uzumzor to the east and the small settlement located at Hazara Degaron Masjidi to the south are of sufficient distance from the site to ensure operational impacts are not likely to be significant.

Should additional mitigation be required during the operational phase, the following will be considered if required following detailed noise assessment:

- Installation of acoustic enclosures for equipment causing radiating noise (this would typically give 3 dB attenuation).
- Improving the acoustic performance of constructed buildings, through employing sound insulation.
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective.
- Installing vibration isolation for mechanical equipment.

In addition, the Project grievance mechanism developed under IFC PS 1 will be implemented during both the construction and operational Project phases. This will be utilised to record, monitor and respond to / mitigate any noise related impacts raised by the local community and ensure compliance with noise limits is achieved at NSRs.

8.6 Social Mitigation and Enhancement

The following sections provide indicative measures to mitigate the negative effects and enhance the positive effects of the Project according to the impacts listed in Section 6.

8.6.1 Construction Phase

8.6.1.1 Community Expectations of the Project

- Communicate employment estimates, timeframes and skills requirements clearly to the community on a continuous basis.

- Develop and implement a Labour and Local Content Management Plan in consultation with the community and in a way that meets long term operational needs of the Project as well as the short-term construction needs, taking into account the relatively low skill base of the local population when it comes to solar power related jobs.
- Develop a Community Investment Plan to invest in skills training to enable greater employment of local population throughout Project life, for both construction and operations phases, to start as early as possible ensuring maximum employment during construction.
- Stakeholder Engagement Plan (SEP) has been developed and will be implemented throughout construction and operations. The SEP includes a stakeholder identification, mapping and analysis process, the topics discussed with stakeholders, methods of outreach and a Grievance Mechanism.

8.6.1.2 Increased local employment, capacity building and supply demand

- Investigate local sourcing and procurement opportunities to promote sustainable small business development.
- Invest in capacity building for small businesses to enable them to meet standards for procurement required by the company and to service the needs of influx populations and indirect employees (through service industries).
- Work with local vocational training schools to develop curricula which will qualify local students to better meet the needs to the developing solar industry locally.
- Development of a Community Investment Plan to invest in skills training to enable greater employment of local population throughout Project life, for both construction and operations phases, to start as early as possible ensuring maximum employment during construction.
- Implement a local hiring plan in consultation with the community and in a way that meets long term operational needs of the Project as well as the short-term construction needs, taking into account the relatively low skill base of the local population when it comes to solar power related jobs. The local hiring plan must be developed in accordance with national labour law and in alignment with International Labour Organisation (ILO) core labour conventions as required by the international standards.

8.6.1.3 Capacity strain contribution to local public services and facilities

- Develop, in conjunction with local government authorities and other companies in the area, mitigation to address potential indirect impacts of the Project on the local community, including on community infrastructure such as water supply, public health infrastructure and waste water treatment.
- Water use and resource studies will be conducted to understand the water use requirements of the Project and the water resources available in the region, to ensure that water is obtained from suitable sources and the Project does not have a negative impact on the current water supply for local communities and agriculture in the area.
- Ensure that all Contractors are provided with adequate health care (for work related injuries and off the job-related health issues) that is independent of the local health care system.
- Liaise with local health professionals to identify ways in which the Project can provide sustainable investments in the health care facilities used by their workers.
- Ensure that within code of conduct it is made clear that workers and employees should not use any community boreholes or water from the river located just east of the Project site. Ensure a system of penalties is put in place for non-compliance.
- Monitor compliance via the grievance mechanism in the Stakeholder Engagement Plan (SEP).
- Water use and resource studies will be conducted to understand the water use requirements of the Project and the water resources available in the region, to ensure that water is obtained from suitable sources and the Project does not have a negative impact on the current water supply for local communities and agriculture in the area.

8.6.1.4 Loss of public access and reduced mobility through local paths (CON & OP)

- Provide detailed and regular information to local community members about Project activity to mitigate community concerns as a result of misinformation.
- Disclose alternative access paths around the site in a timely manner to local farm sub-tenants and nearby grazing / pastoral farmers who may informally graze or cross through the site paths.
- Stakeholder Engagement Plan (SEP) to be implemented.

8.6.1.5 Reduced access to grazing and pastoral land

- No physical resettlement from the PV area of the Project site will be required. The transmission line is outside the scope of the Project.
- The loss of livelihood due to the removal of grazing areas during construction and operation will need to be addressed through the provision of like for like compensation i.e. alternative land. Changes to baseline conditions will be further assessed in the full ESIA, including any potential gaps between the compensation received by the sub-tenants and what they would be entitled to under international practices (ADB Safeguard Requirement 2, and IFC PS 5), including compensation for any losses.
- Provide detailed and regular information to local community members about Project activity to mitigate community concerns as a result of misinformation.
- Stakeholder Engagement Plan to be implemented.

8.6.1.6 Increased presence of workers and interaction with local communities

- Development and implementation of a Community Health and Safety Plan.
- As part of health and safety induction for workers, provide awareness training on communicable disease prevention, sexual exploitation and harassment awareness. Provide this training on an ongoing basis to promote gender equality and prevent any form of gender-based violence.
- Ensure health screening is being conducted for employees and contractors before contracting workers and on a periodic basis throughout their employment/contract.
- Identify opportunities to support local public health campaigns that focus on prevention of communicable diseases.
- Enforce and monitor a zero-alcohol tolerance policy, including current intoxication, for workers during working hours.
- Ensure random alcohol testing is conducted for workers entering and leaving the site.
- Design a system of penalties for anyone found with alcohol on site.
- Ensure that Project security is aware of the Project's goals to establish good relationships with local stakeholders; the grievance mechanism for communities to voice concerns; and receives human rights and cultural sensitivity training to ensure the respect and protection of the local community.

8.6.1.7 Increased road traffic

- To mitigate the potential traffic related impacts from the Project, a Traffic Management Plan, comprising strategies to manage vehicles and equipment during the execution of the Project will be implemented. The Traffic Management Plan will describe the measures put in place by the Project to control movement of delivery vehicles, personnel transportation vehicles, and protect pedestrians walking near the planned routes.
- It is recommended that the efficiency of deliveries of construction materials to the site is closely monitored and, if necessary, sufficient storage provision is made available on site to prevent any delays to the construction process.

- The transportation of equipment and materials to site from the border with China utilises paved highways and dual carriageways which are suitable for and regularly used by HGV vehicles. There is an alternative option of using the railway between China and the Project site. Upgrade works may be required for several roads in the vicinity of the Project site due to the presence of potholes and poorly maintained bridges. This would be verified through further route inspection prior to construction.

8.6.1.8 Increased presence of security personnel

- Ensure that Project security is aware of the Project's goals to establish good relationships with local stakeholders; the grievance mechanism for communities to voice concerns; and receives human rights and cultural sensitivity training to ensure the respect of the local community when interactions with community members occur within the Project site or in its immediate vicinity.
- All security incidents will be investigated along the local authorities as required by law, and security grievances will be identified and actioned.
- Security personnel will be vetted and trained to IFC PS4. Security personnel will only operate within the Project site boundary.

8.6.1.9 Unplanned events: Potential workforce H&S risks

- The Project Developer and its contractors will comply with international Occupational Health & Safety regulations and standards (for example, Directive 89/391[67] and OSHA[68] standards) in addition to Uzbek safety standards regarding construction works, electrical works, structural climbing and other hazards. In general, construction operations will be planned and implemented in accordance with these standards and with IFC safety guidelines[69]. Furthermore, the EPC Contractor will be required to demonstrate and implement a suitable management system which confirms to the standards equivalent to ISO 9001, ISO 14001 and OSHAS 18001. This will be a key contractual requirement and will be monitored by the Developer.
- Both the Developer and all its contractors will be required to produce a Health and Safety Plan for both construction and operational phases and will bring together the mitigation requirements discussed in preceding sections.
- Develop and implement an Occupational Health and Safety Plan and a Community Health and Safety Plan prior to construction.
- Develop an emergency response plan (ERP) - this plan will be developed in conjunction with the Occupational Health and Safety Plan and Community Health and Safety Plan.
- Work with local emergency responders to at minimum: (i) communicate ERP; (ii) depending on level of risk from emergency events build local capacity to ensure appropriate local response in case of emergency.
- Communicate potential risks and ERP to those potentially most affected by emergency events.

8.6.1.10 Unplanned events: pollution and road incidents and accidents

Potential pollution on grazing soil or on public health:

- Implementation and compliance with a Traffic Management Plan which should identify the strategies used to manage dust on the road during the execution of the Project.
- Implementation and compliance with the Dust Management Plan (part of the overall ESMP).
- Use of properly maintained vehicles and construction equipment with emission controls.

[67] European Union Council Directive 89/391/EEC
[68] Code of Federal Regulations (1974) 39 FR 23502
[69] IFC (2007a)

- Communicate project risk to local communities and address concerns accordingly. Monitor any complaints filed (via grievance mechanism) from local stakeholders as an additional tool to monitor dust management measures.
- Implementation of the Waste Management Plan, to ensure that household and project waste is disposed of in line with Uzbek standards.
- Where appropriate, support local public health campaigns against food and water borne diseases.
- The temporary construction area and substation will have a local effluent collection and/or treatment system. The contractor will design, build and operate these systems in accordance with Uzbek legislation.
- Effluent from domestic sewerage treatment shall meet the relevant standards acceptable to the environmental authorities.

Potential harm by road incidents and accidents:

- Development and implementation of Traffic Management Plan.

8.6.2 Operation Phase

8.6.2.1 Unmet Project expectations

- Stakeholder Engagement Plan to be developed and implemented.
- Develop a Community Investment Plan to invest in skills training to enable greater employment of local population throughout Project life, for both construction and operations phases, to start as early as possible ensuring maximum employment during construction.

8.6.2.2 Increased local employment, capacity building and supply demand

- Development of a Community Investment Plan to invest in skills training to enable greater employment of local population throughout Project life, for both construction and operations phases

8.6.2.3 Loss of public access and reduced mobility through local paths

- Provide information to local community members about Project activity to mitigate community concerns as a result of misinformation.
- Stakeholder Engagement Plan to be developed and implemented.

8.6.2.4 Reduced access to grazing and pastoral land

- Provide information to local community members about Project activity to mitigate community concerns as a result of misinformation.
- Stakeholder Engagement Plan to be developed and implemented.

8.6.2.5 Increased presence of security personnel

- Ensure that Project security is aware of the Project's goals to establish good relationships with local stakeholders; the grievance mechanism for communities to voice concerns; and receives human rights and cultural sensitivity training to ensure the respect and protection of the local community.
- All security incidents will be investigated, and security grievances will be identified and actioned.
- Security personnel will be vetted and trained to IFC PS4. Security personnel will only operate within the Project site boundary.

8.6.2.6 Unplanned events: Potential workforce H&S risks

Same as Section 7.6.1.9.

8.7 Occupational and Community Health and Safety

The Project Developer and its contractors will comply with international Occupational Health & Safety regulations and standards (for example, Directive 89/391[70] and OSHA[71] standards) in addition to Uzbek safety standards regarding construction works, electrical works, structural climbing and other hazards. In general, construction operations will be planned and implemented in accordance with these standards and with IFC health and safety guidelines[72]. Furthermore, the EPC Contractor will be required to demonstrate and implement a suitable management system which confirms to the standards equivalent to ISO 9001, ISO 14001 and OSHAS 18001. This will be a key contractual requirement and will be monitored by the Developer.

Both the Developer and all its contractors will be required to produce a Health and Safety Plan for both construction and operational phases and will bring together the mitigation requirements discussed in preceding sections.

With regards to the construction workforce, a local labour force will be employed to the maximum extent possible and wages will be paid which are at least average for the area.

A Project Community Health and Safety Plan will also be developed. This will describe the potential hazards of the Project during construction, commissioning and operation to local communities and how these will be controlled. The document will set out community health and safety mitigation measures and the use of land surrounding the site for agricultural / grazing purposes. The document will also outline emergency preparedness and response along with a grievance mechanism to ensure that feedback is acknowledged and addressed appropriately.

8.8 Traffic and Transportation

It is recommended that the efficiency of deliveries of construction materials to the site is closely monitored and, if necessary, sufficient storage provision is made available on site to prevent any delays to the construction process.

A Traffic Management Plan (TMP) will be developed which will reduce risks to drivers and components being transported. This will include (amongst others):

- Detailed site access route.
- Speed controls (such as speed limits, signs, speed bumps etc.).
- Measures for ensuring use of well-maintained vehicles which are serviced regularly.
- Measures to maintain / make good the access roads.
- Details of the temporary site compound which should include parking for up to 40 light vehicles including a HGV manoeuvring, holding and unloading areas.
- Information regarding road safety briefings which will be given to all staff and contractors.
- Procedures for ensuring appropriate licenses / permits are in place for all drivers and provision of suitable training to reduce potential accidents on route to, and within, the site.
- Measures to control the delivery / departure of all HGVs to avoid conflict with other road users.
- Detail sensitive receptors en-route and ensure all drivers are aware of these.
- It is recommended that the route for use by HGVs is verified through further assessment (including a route inspection undertaken prior to construction). Consultation with the relevant Roads Authority is recommended to further identify the most appropriate route and any permits or additional mitigation measures required.

The transportation of equipment and materials to site from the border with China utilises paved highways and dual carriageways which are suitable for and regularly used by HGV vehicles. Upgrade works may be required for several roads in the vicinity of the Project site due to the presence of potholes and poorly maintained bridges. This would be verified through further route inspection prior to construction.

[70] European Union Council Directive 89/391/EEC
[71] Code of Federal Regulations (1974) 39 FR 23502
[72] IFC (2007)

Mitigation has been proposed to alleviate potential impacts and these measures should be incorporated into a Construction Transportation Management Plan (TMP) for use prior to and during construction.

Overall, the assessment concludes that there will be no significant residual effects associated with transportation of materials and equipment during the construction and operation phases of the Project.

8.9 Archaeology and Cultural Heritage

8.9.1 Construction Phase

Although there are not likely to be direct impacts on any features during construction, mitigation will focus on the implementation an appropriate archaeological chance finds procedure during initial construction works to identify any uncovered archaeological features.

In accordance with the requirements of IFC PS8 (Cultural Heritage), a chance find procedure will be developed which will be applied in the event that cultural heritage is subsequently discovered. The Developer or its contractors will not disturb any chance find further until an assessment by a competent professional is made and actions consistent with the requirements of PS8 are identified.

An archaeological chance finds procedure is defined as a formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons (i.e. construction of a solar PV project) within a specified area or site where there is the possibility that archaeological deposits may be disturbed or destroyed (the working area). The procedure will result in the preparation of a report and ordered archive.

An archaeological chance finds procedure will in all cases be intended:

- To allow, within the resources available, the preservation by record of archaeological deposits. The presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works.
- To provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated to the chance find procedure itself are not sufficient to support a treatment to a satisfactory and proper standard.

The archaeological chance finds procedure will be intended to establish and make available information about the archaeological resource existing on the site.

During construction, toolbox talks will be provided to ensure that workers will be alert to any signs of past cultural activity in the area. Should any artefacts or evidence of past activity be discovered, it is important that they are protected, the appropriate authorities notified immediately, and no action taken that would disturb the resources until feedback has been provided.

9. Summary and Next Steps

9.1 Summary

The aim of this study was to carry out a preliminary assessment of the proposed 100 MW Nur Navoi Solar PV Project to determine whether or not the Project and the associated infrastructure would have any adverse environment and social effects. The study involved an assessment of the baseline environment; review of the relevant legislation; stakeholder engagement including public participation and consultation, which will be further analysed in subsequent site visits; identification of potential environment impacts during the pre-construction, construction, operation and decommissioning phases of the Project; and development of an appropriate management framework for the mitigation of negative effects associated with the proposed Project.

Based on the study findings, the following conclusions have been reached and the following recommendations made.

- Project stakeholders include international organizations and funding institutions who will provide investment and sustainable financing, meeting the aims of Uzbekistan's Green Economy Strategy.
- The proposed Project will produce clean energy from indigenous sources which will reduce Uzbekistan's contribution to climate change, through a reduction in the use of fossil fuels required to drive thermal power plants. Thermal power plants are costly and increase the carbon load. The Project therefore feeds directly into Uzbekistan's low carbon pathway strategies.
- Positive impacts of the proposed Project are expected through the impacts on the regional and national economy during the construction and operation phases and impacts from local employment and training during construction and operation.
- The proposed Project has potential to cause some level of negative environmental and social effects mainly in relation to the tenant farmer who has not been involved in the decision-making process and is deemed to be vulnerable to the impacts of the Project.
- The assessment of other impacts through the ESIA process has demonstrated that, with the implementation of committed mitigation measures during the construction, operational and decommissioning activities of the Project, the impacts can be adequately managed.

9.2 Next Steps

The general recommendation from the ESIA study is that the proposed 100 MW Nur Navoi Solar Plant Project should proceed but in order to ensure the environmental and social sustainability of the proposed Project, it is recommended that the Proponent implements the following:

- Further environmental and social surveys will be undertaken as part of the detailed ESIA phase. This will include further ecology survey effort, stakeholder engagement and household socio-economic surveys. Such surveys are programmed to take place during the week of 22 June 2020.
- Assess residual effects of the Project and further develop mitigation measures.
- Monitor discussions with tenant farmer to confirm that like for like compensation has been provided. The Project should facilitate negotiations with relevant members of the Khokimyiat.
- Develop and implement a Project ESMP to mitigate negative impacts and enhance the positive impacts. The ESMP requires that the proposed Project follows the recommended mitigation measures; and livelihood and community benefit enhancement strategies.
- Confirm the need for worker accommodation and if necessary, develop a Workers Accommodation Plan. Given current Covid-19 restrictions, the Project is planning to install workers camp.
- Project will carry out a skills audit and develop a Local Hiring Policy that would identify and prioritise local community employment opportunities to ensure gender equity in human resource recruitment.
- Further develop and implement a Stakeholder Engagement Plan and commit to a pro-active and continuous stakeholder engagement process to address emerging project issues and to continue the enlightenment of the community on Project benefits. Community engagement should be undertaken in close collaboration with the local administration (local representatives and the county leadership).

Appendix A Figures

SEE SEPARATE ATTACHMENT

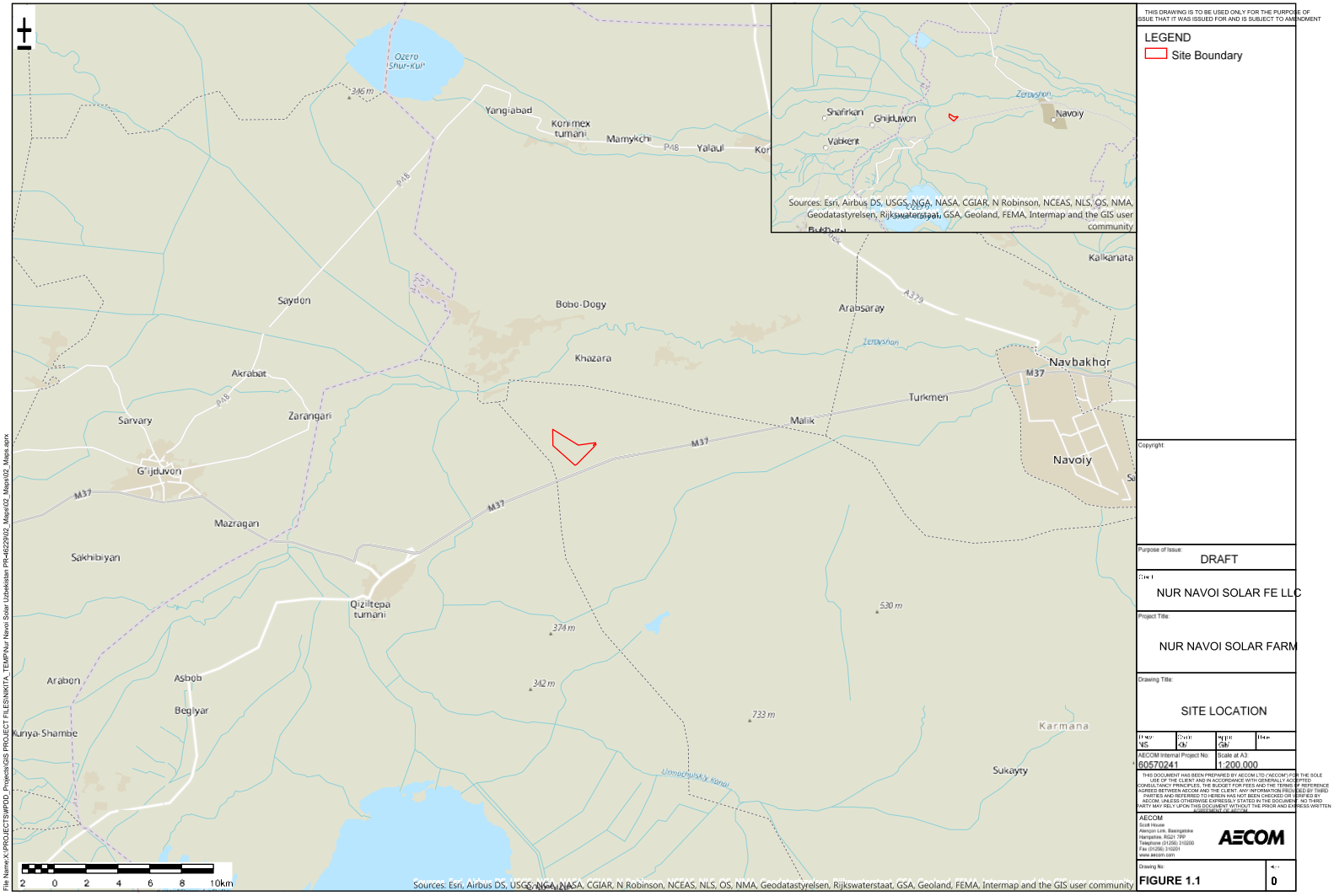

Figure 1.1 - Site Location

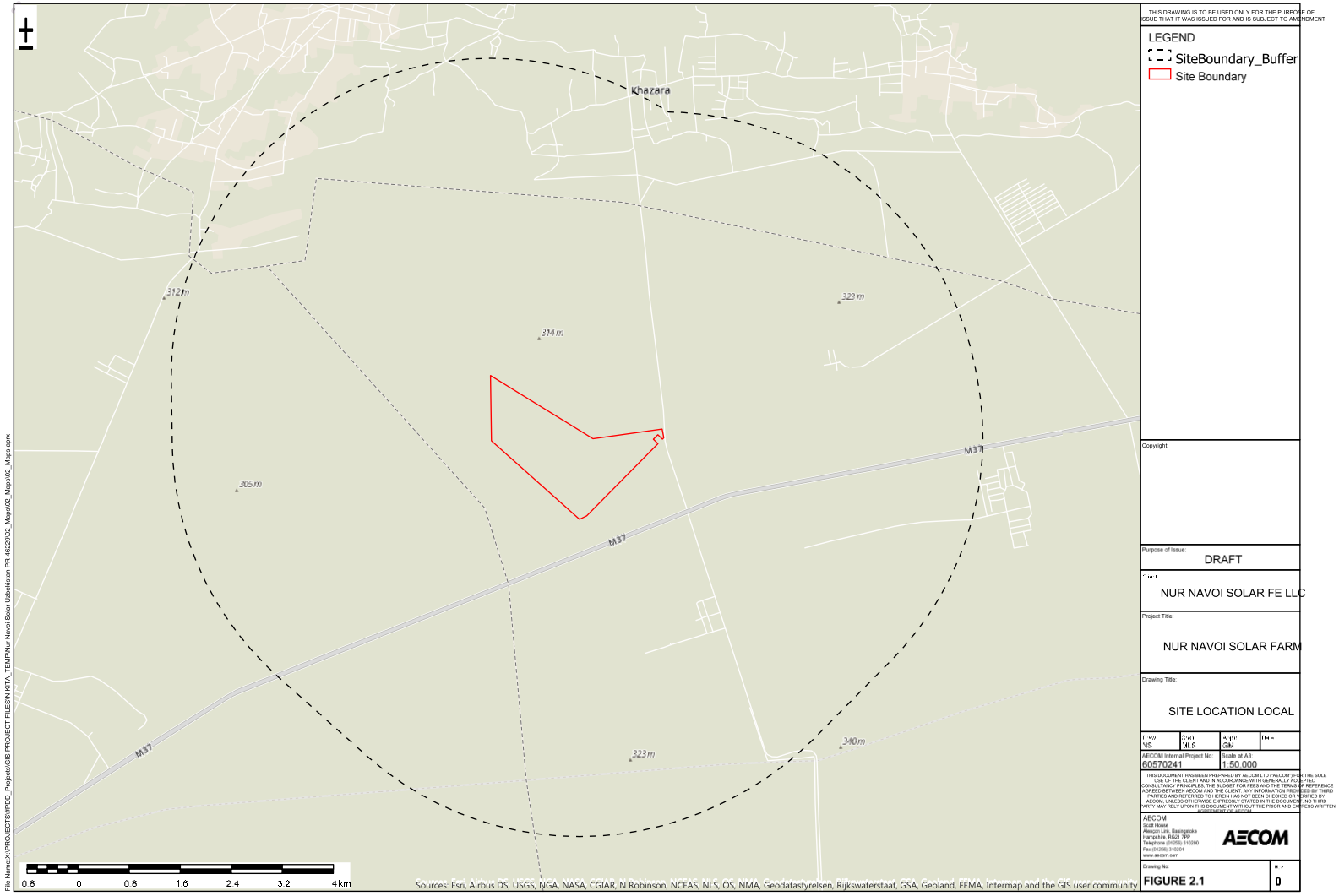

Figure 2.1 - Site Location Local

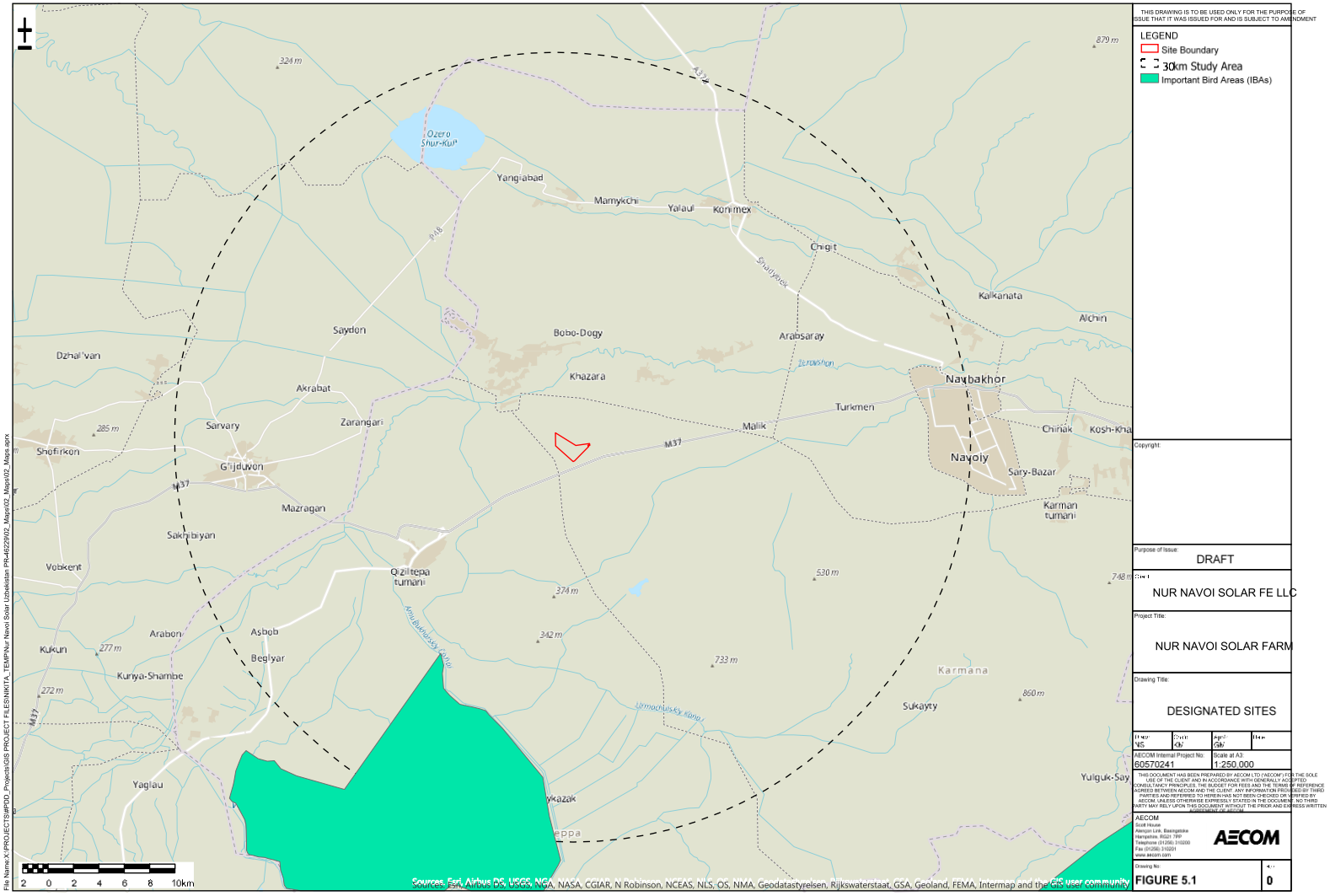

Figure 5.1 - Designated sites

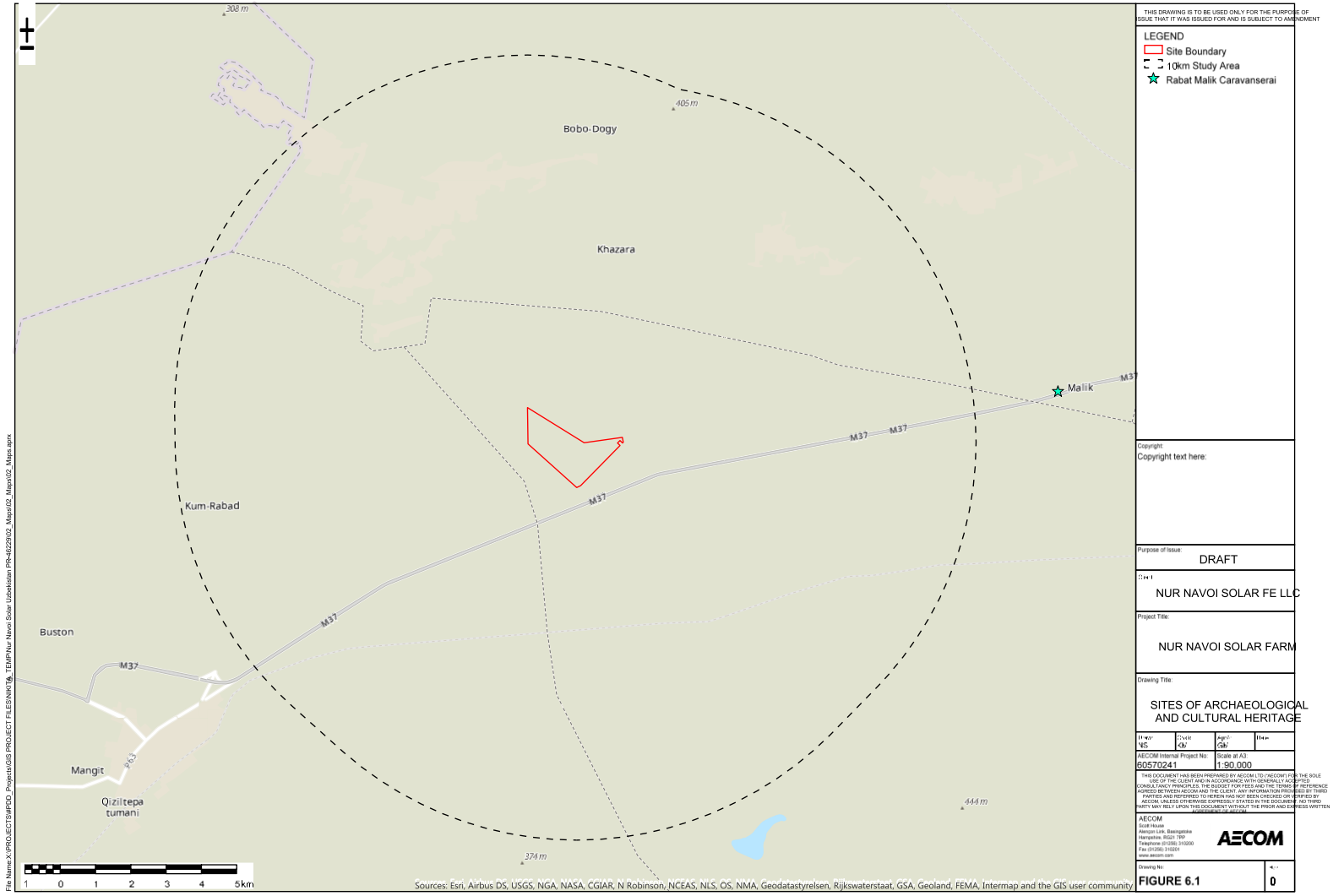

Figure 6.1 - Sites of Archaeological Interest

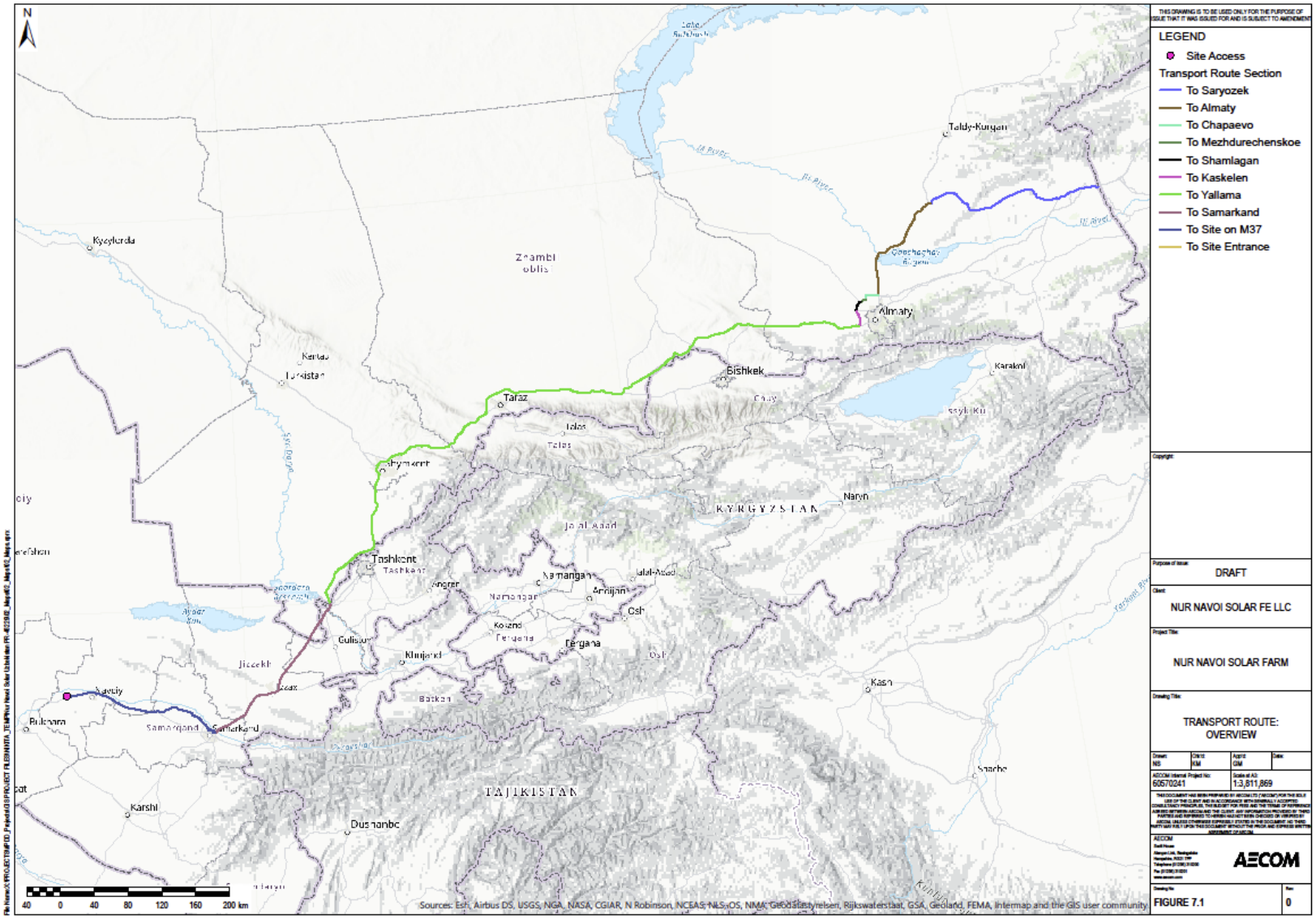

Figure 7.1 - Transport Route

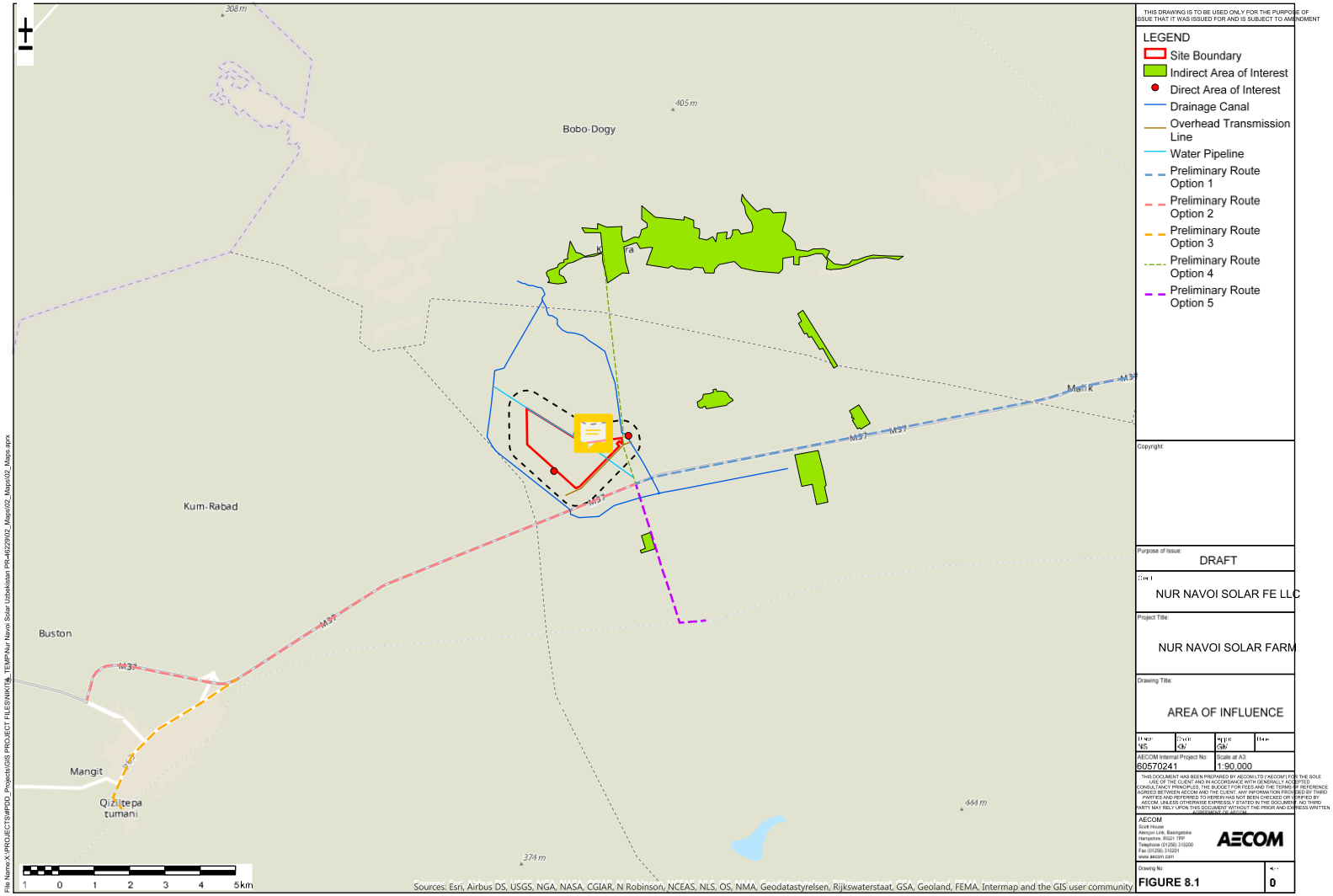

Figure 8.1 - Area of Influence

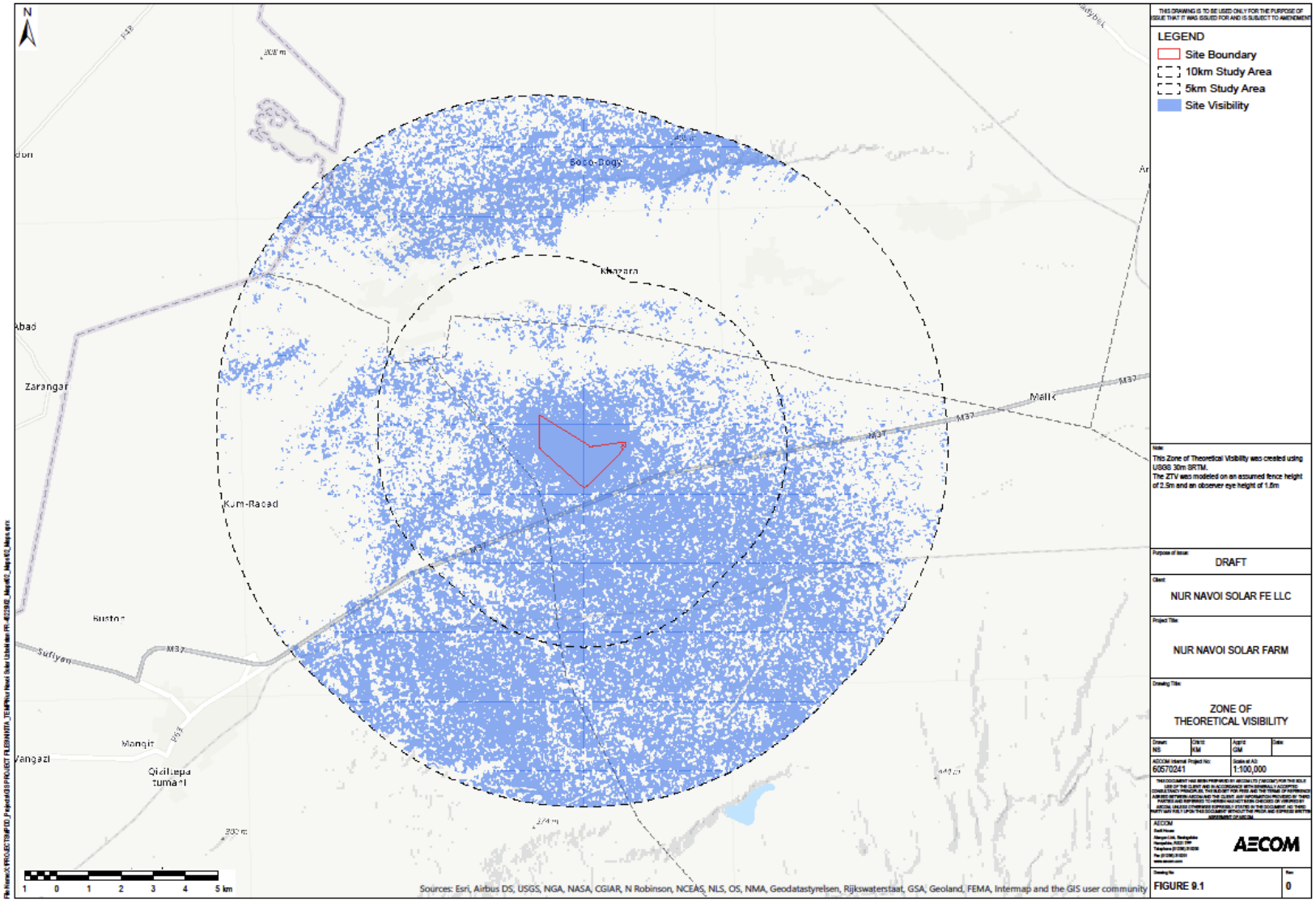

Figure 9.1 - Zone of Theoretical Visibility

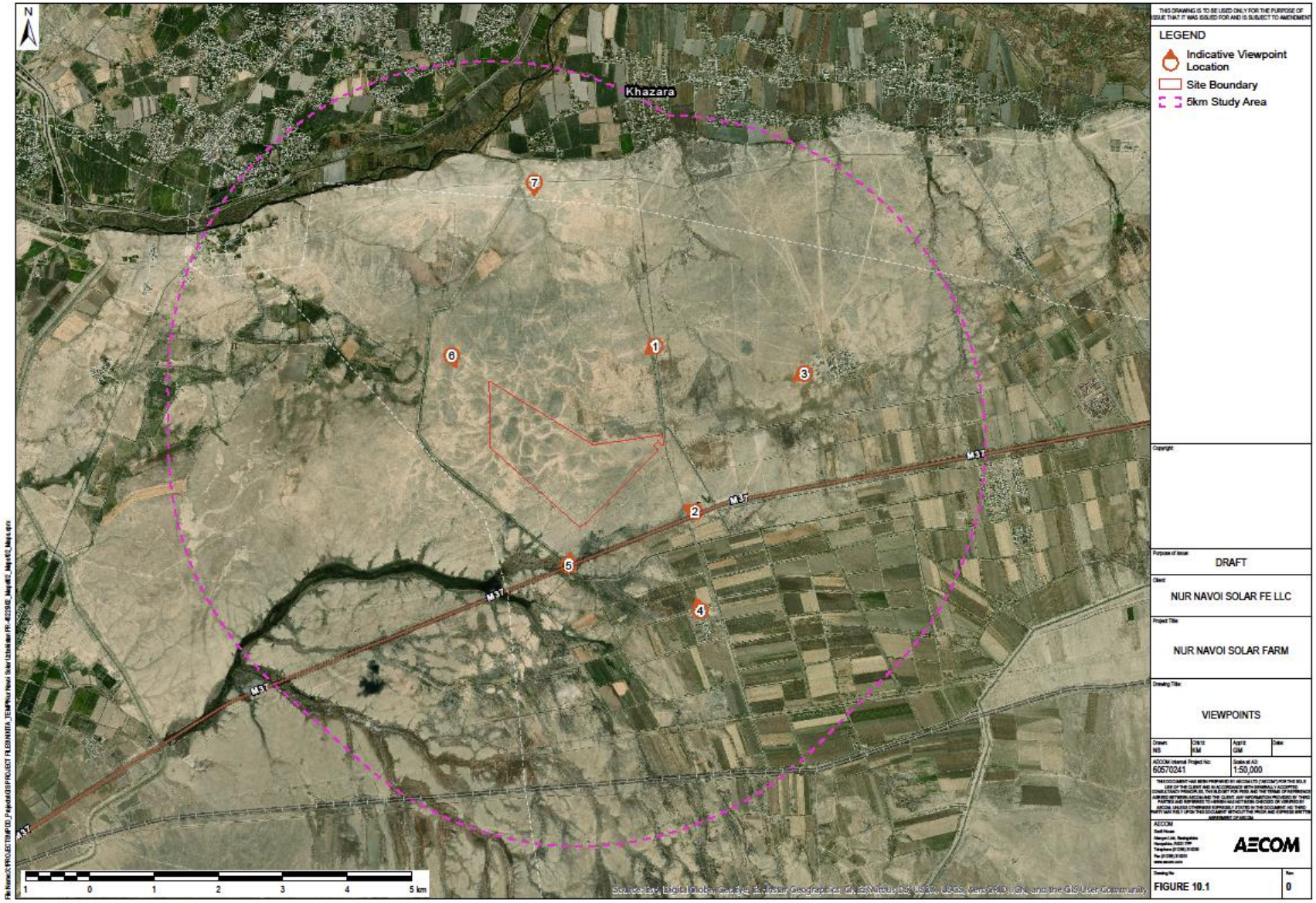

Figure 10.1 - Viewpoints

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