Nur Bukhara Solar PV and BESS Project

Volume II – Environmental & Social Impact Assessment

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Disclaimer

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Abbreviations

Acronym	Term
ABCD	Amu-Bukhara Canal Department
ABIS	Amu-Bukhara Irrigation System
AC	Alternating Current
AoA	Analysis of Alternatives
AoI	Area of Influence
AP	Action Plan
BESS	Battery energy storage system
CBD	Convention on Biological Diversity
CBO	Community Based Organisations
CCTV	Closed circuit television
CHA	Critical Habitat Assessment
CHS	Community Health and Safety
CSR	Corporate Social Responsibility
DC	Direct Current
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering, Procurement, and Construction
EPRP	Emergency Preparedness and Response Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GIS	Geographical Information System

Acronym	Term
GOU	Government of Uzbekistan
HR	Human resources
IFC	International Finance Corporation
ILO	International Labour Organisation
IP	Indigenous peoples
IUCN	International Union for Conservation of Nature
LLA	Land lease agreement
LRP	Livelihood Restoration Plan
MAWR	Ministry of Agriculture and Water Resources
MPC	Maximum permitted concentration
NCR	Non-compliance report
NTS	Non-Technical Summary
O&M	Operation and Maintenance
OESMP	Operational environmental and social management plan
OHTL	Overhead transmission line
OHS	Occupational Health and Safety
OPEX	Operating Expenditures
PM	Particulate Matter
POPs	Persistent organic Pollutants
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PPP	Public private partnership
PRs	Performance Requirements
PS	Performance Standards
PV	Photovoltaic
RoW	Rights of Way

Acronym	Term
SEP	Stakeholder Engagement Plan
SWID	Sericulture and Wool Industry Development
SWMP	Site Waste Management Plan
TTMP	Traffic and Transportation Management Plan
ToR	Terms of Reference
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USTDA	United States Trade and Development Agency
WBG	World Bank Group
WHO	World Health Organisation
WMP	Waste Management Plan
WPZ	Water Protection Zone

Glossary

Term	Definitions
Area of Influence (AOI)	The area over which the impacts of the Project are likely to be felt, as well as any reasonably foreseen unplanned developments induced by the Project or cumulative impacts.
Associated facilities	Facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable.
Baseline surveys	Gathering of data to describe the existing physical, biological, socioeconomic, health, labour, cultural heritage, or any other variable considered relevant before project development
Biodiversity	Variability among living organisms from all sources, including, among other things, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems.
Chance finds	Archaeological or cultural sites and artefacts, including such items as ceramics, tools, buildings, burials, etc., previously unrecognized in baseline studies that are discovered during exploration activities.
Consultation	Consultation is a two-way dialogue process between the project company and its stakeholders. Stakeholder consultation is about initiating and sustaining constructive external relationships over time.
Critical habitat	Either modified or natural habitats supporting high biodiversity value, such as habitat required for the survival of critically endangered or endangered species.
Cultural heritage	Defined as resources with which people identify as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions.
Cumulative impacts	The combination of multiple impacts arising from existing projects or activities and/or anticipated future projects or activities.
Direct area of influence	Considers the physical footprint of the projects, such as the right of way, construction sites, work staging area and area affected during operational works (e.g., traffic patterns).
Effluent	Wastewater - treated or untreated- that flows out of a treatment plant, sewer, or industrial outfall.
Emission	Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and motor vehicle, locomotive, or aircraft exhausts.
Environmental and Social Impact	A forward-looking instrument that can proactively advise decision-makers on what might happen if a proposed activity is implemented. Impacts are changes that have environmental, political, economic, or social significance to society. Impacts

Term	Definitions
Assessment (ESIA)	may be positive or negative and may affect the environment, communities, human health and well-being, desired sustainability objectives, or a combination of these.
Environmental and Social Management Plan (ESMP)	Summarises the company's commitments to address and mitigate risks and impacts identified as part of the ESIA through avoidance, minimization, and compensation/offset and to monitor these mitigation measures.
Environmental and social management system (ESMS)	Part of the Project's overall management system includes the organizational structure, responsibilities, practices and resources necessary for implementing the project-specific management program developed through the environmental and social assessment of the Project.
Good International Industry Practice (GIIP)	Exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally. The outcome of such an exercise should be that the project employs the most appropriate technologies in the project-specific circumstances.
Grievance mechanism	The procedure provided by a project to receive and facilitate the resolution of affected communities' concerns and grievances about the project's environmental and social performance.
Habitat	Terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment.
Hazardous waste	By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Substances classified as hazardous wastes possess at least one of four characteristics—ignitability, corrosivity, reactivity, or toxicity— or appear on special lists.
Indigenous peoples	Defined by the World Bank E&S Framework as a distinct social and cultural group possessing the following characteristics in varying degrees: (a) Self-identification as members of a distinct indigenous social and cultural group and recognition of this identity by others; (b) Collective attachment to geographically distinct habitats, ancestral territories, or areas of seasonal use or occupation, as well as to the natural resources in these areas; (c) Customary cultural, economic, social, or political institutions that are distinct or separate from those of the mainstream society or culture; and (d) A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.
Indirect area of influence	Includes areas which may experience project-related changes in combination with activities not under the project's direct control.
Information disclosure	Disclosure means making information accessible to interested and affected parties (stakeholders). Communicating information in a manner that is understandable to stakeholders is an essential first and ongoing step in stakeholder engagement. Information should be disclosed before all other engagement activities, from consultation and informed participation to negotiating and resolving grievances. This will make engagement more constructive.

Term	Definitions
Intangible cultural heritage	According to the 2003 UNESCO Convention for the Safeguarding of intangible cultural heritage, manifestations of intangible cultural heritage include Oral traditions and expressions, including language; Performing arts; Social practices, rituals and festive events; Knowledge and practices concerning nature and the universe.
Land acquisition	All methods of obtaining land for project purposes may include outright purchase, expropriation of property and acquisition of access rights, such as easements or rights of way.
Livelihood	Full range of means that individuals, families, and communities utilize to make a living, such as wage-based income, agriculture, fishing, foraging, other natural resource-based livelihoods, petty trade, and bartering.
Magnitude	The assessment of magnitude is undertaken in two steps. Firstly, the magnitude of potential impacts associated with the Project is categorized as beneficial or adverse. Secondly, the beneficial or adverse impacts are categorized as high, medium or low based on several parameters.
Modified habitat	Land and water areas where there has been an apparent alteration of the natural habitat, often with the introduction of alien species of plants and animals, such as agricultural areas.
Natural habitat	Land and water areas where the biological communities are mainly formed by native plant and animal species and where human activity has not essentially modified the area's primary ecological functions.
Occupational health and safety	The range of endeavours aimed at protecting workers from injury or illness associated with exposure to hazards in the workplace or while working.
Project affected people	Individuals, workers, groups or local communities which are or could be affected by the project, directly or indirectly, including through cumulative impacts.
Renewable energy	Energy sources derived from solar power, hydro, wind, certain types of geothermal, and biomass
Sensitivity	The sensitivity of a receptor is determined based on the review of the population (including proximity/numbers/vulnerability), presence of biological features of the site and the surrounding area, soil, agricultural suitability, geology and geomorphology, the proximity of aquifers and watercourses, existing air quality, presence of any archaeological features etc.
Significance	The significance of an impact considers the interaction between the magnitude and sensitivity criteria.
Solid waste	Material with low liquid content is sometimes hazardous. Include municipal garbage, industrial and commercial waste, sewage sludge, wastes resulting from agricultural and animal husbandry operations and other connected activities, demolition wastes and mining residues

Term	Definitions
Stakeholders	Stakeholders are persons or groups directly or indirectly affected by a project, as well as those who may have interests in a project or the ability to influence its outcome, either positively or negatively.
World Bank Group EHS Guidelines	Technical reference documents for environmental protection that set out industry-specific examples of 'international good practice'. Projects are expected to comply with the levels and measures identified in the General EHS Guidelines where host country requirements are less stringent or do not exist.

1 Introduction

1.1 Background

Abu Dhabi Future Energy Company PJSC ("Masdar") has been awarded by the Ministry of Energy, Government of Uzbekistan (GOU), to design, build, finance, construct, commission and operate, maintain and transfer (DBFOMT) the Nur Bukhara Solar photovoltaic (PV) Project with a capacity of 250 MWA and 63 MW/126 MWh Battery Energy Storage System (BESS) ("Project"). The Project will be implemented through a long-term, i.e., 25 years power purchase agreement (a "PPA") between Nur Bukhara Solar PV LLC Foreign Enterprise ("the Project Company") and JSC National Electric Grid of Uzbekistan ("NEGU").

The Project will support Uzbekistan to:

- Reduce energy dependence on carbon-based fuels.
- Meet renewable energy targets.
- Reduce greenhouse gas emission rates.

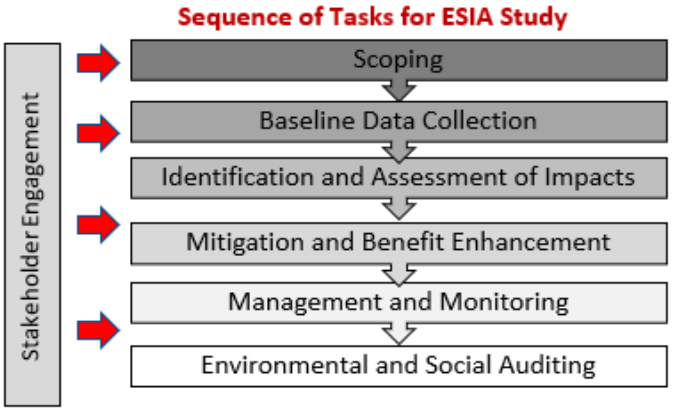
Masdar has appointed Juru Energy Ltd. (JE or the Consultant) to perform an Environmental and Social Impact Assessment (ESIA) for the Project. The ESIA will be developed in accordance with national standards, the requirements of the International Finance Corporation (IFC) Environmental and Social Policy (ESP) (2019) and supporting Performance Standards (PSs), Asian Development Bank (ADB) Safeguard Policy Statement (SPS) 2009, and with reference to EBRD Environmental and Social Policy 2019 (ESP 2019) Performance Requirements (PRs) and the Equator Principles IV (EPIV).

The Project is required to undergo a separate national environmental impact assessment (EIA) process. Stage 1 has been submitted as a separate document to the Ministry of Natural Resources for approval (Application Number 81208) on 22 May 2023, the response was received on 26 June 2023. Further documentation required for Stage 2 has been submitted on 06 August 2023. Stage 2 was approved on 22 August 2023[1]. The sequence of steps for the EIA and ESIA study is presented in

Figure 1. This report presents the findings of the environmental and social impact assessment process.

[1] Stage 2 Conclusion is provided in Volume III: Technical Annexes.

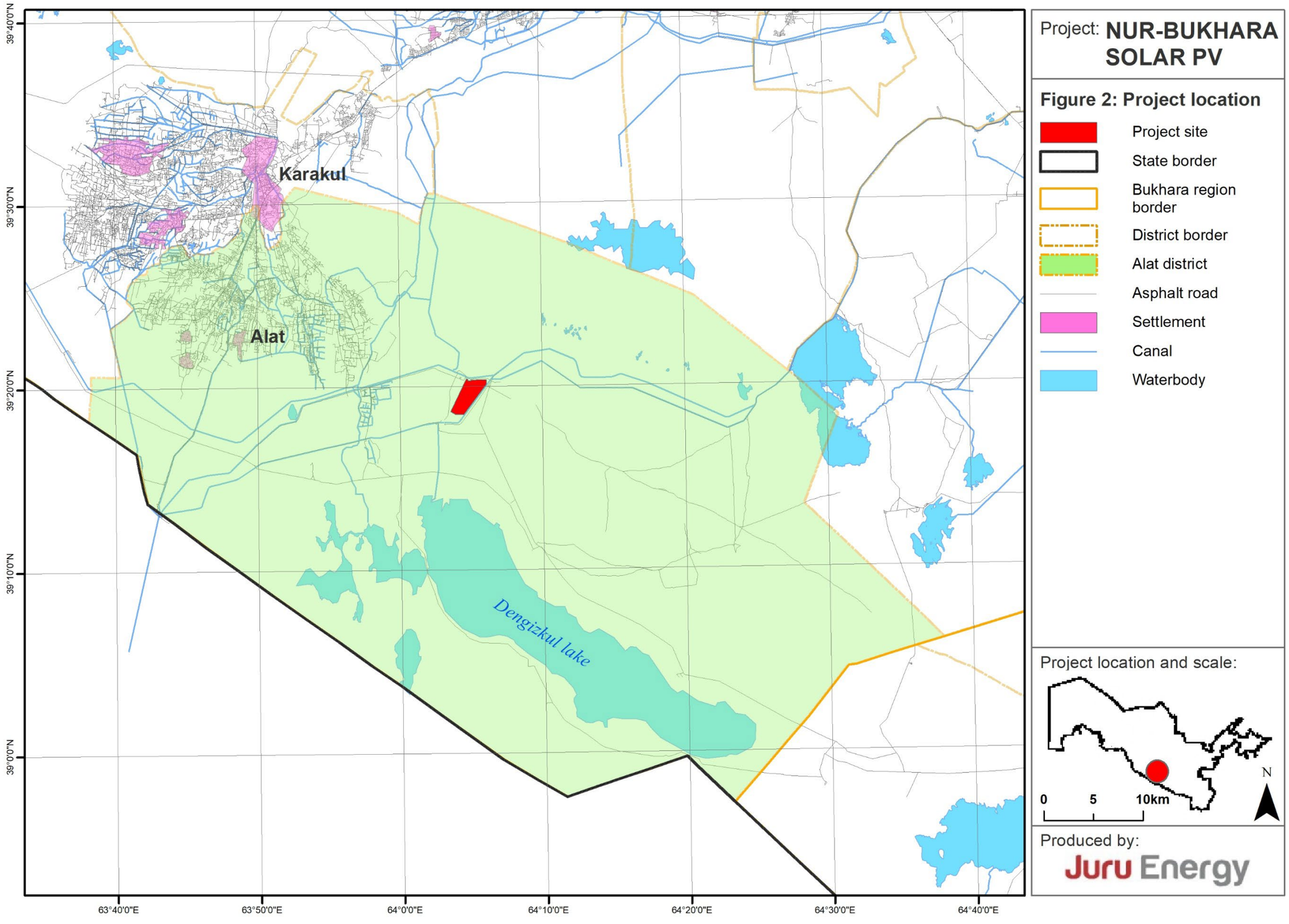
Figure 1: ESIA process - sequence of steps (source: Juru Energy)



2 Project overview

The Site covers approximately 645 ha of land in the Alat District of the Bukhara region, a region in the southwest of the Republic of Uzbekistan. It is located 24 km southeast of Alat city, close to the border with Turkmenistan, which at the closest point lies around 25 km southeast of the Site. The proposed Site is flat and is surrounded by the Amu-Bukhara Irrigation System (ABIS canal) to the North, South and East. The regional road R78 runs alongside the northern boundary of the site. The location of the Project is illustrated in Figure 2.

Figure 2: Project location



2.1 Purpose of the ESIA

The purpose of this ESIA is to:

- Identify and evaluate potential environmental and social impacts the Project may have on the environment and communities within its area of influence (AOI) (positive and negative).
- Avoid, or where avoidance is not possible, minimize, mitigate, or compensate adverse environmental or social impacts and issues to workers, affected communities and persons, and the environment from project activities, including involuntary resettlement impacts.
- Implement a systematic approach to stakeholder engagement to build and maintain a constructive relationship with stakeholders, particularly the directly affected communities.
- Establish a pre-project baseline against which future monitored may be compared.
- Determine whether there are any involuntary resettlement impacts (e.g., land acquisition, displacement; and ascertain any adverse impacts on livelihoods for the local population.
- Define environmental and social management and monitoring requirements through the effective use of an environmental and social management plan (ESMP) and relevant resettlement documentation.
- Align with national requirements for environmental and social impact assessment.
- Demonstrate compliance with Lender requirements.

2.2 Project proponent

Masdar's mission is to develop, invest in and deliver high-quality, sustainable and economically viable clean energy projects locally and globally. Masdar will develop the Nur-Bukhara Solar PV Project and BESS. Masdar has over a decade of experience as a renewable energy developer and investor. Masdar invests in and contributes to innovative global projects, including large, utility-scale renewable energy power plants, community grid projects, and individual solar home systems. It is active across 40 countries and has developed some of the world's most significant solar and wind energy projects. Masdar has invested or committed to invest in renewable energy projects with a gross capacity of over 20 GW. In Uzbekistan, Masdar has a 100 MW utility-scale PV solar plant in operation and another 1,600 MW of projects under various stages of development, i.e., financial closing and construction.

MASDAR

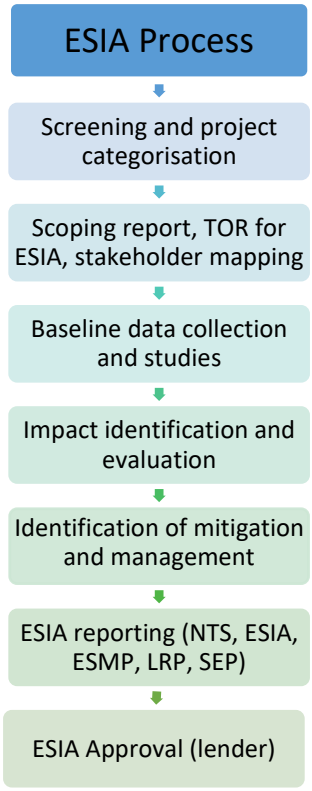
Mission "To be a global clean energy developer, with a reputation of being the partner of choice. We meet the needs of clients and communities alike."

2.3 ESIA approach

The sequence of steps for the ESIA study is presented in

Figure *3*. Stakeholder engagement has been performed throughout the ESIA process and is summarised in section 5. A stakeholder engagement plan (SEP) and evidence of stakeholder engagement performed are provided in Volume VI.

Figure 3: ESIA process - sequence of steps (source: Juru Energy 2021)



A scoping exercise was completed in March 2023 to define the ESIA terms of reference (TOR). The scoping report and ESIA TOR are provided in Volume III: ESIA Technical Appendix.

Field surveys were performed during April and May 2023 and included:

- Biodiversity surveys for flora, mammals, reptiles, amphibians fish and birds.
- Air quality, noise, surface water and soil baseline surveys.
- Socio-economic survey and valuations.
- Archaeological survey.

Baseline survey reports are provided in Volume III: ESIA Technical Appendix. Mitigation and management measures identified in the impact assessment chapters have been collated into a Project ESMP for implementation across subsequent phases of the development cycle. Requirements for livelihood restoration are outlined in the Livelihood Restoration Plan.

2.4 ESIA structure and schedule

The ESIA contains the following volumes:

- Volume I: Non-Technical Summary (English, Uzbek)
- Volume II: ESIA Main Report (English, Russian) (this document)
- Volume III: ESIA Technical Appendices and Supporting Documents (originating language) including:
  - Preliminary permit register
  - Set back approval letter
  - Nur Bukhara scoping report
  - Physical baseline survey reports
  - Biodiversity baseline reports
- Volume IV: Environmental and Social Management Plan (ESMP) (English, Russian)
- Volume V: Livelihood Restoration Plan (LRP) (English, Uzbek)
- Volume VI: Stakeholder Engagement Plan (SEP) (English, Uzbek), including:
  - Annex A: Scoping and ESIA notification leaflet (English and Uzbek)

    - Annexe B: Project grievance form
    - Annexe C: Stakeholder engagement records
- Critical habitat assessment (CHA)
- Human rights impact assessment (HRIA)
- Climate change risk assessment (CCRA)

This ESIA report is structured as follows:

- Chapter 1: Introduction;
- Chapter 2: Project overview;
- Chapter 3: Project description, including needs case and analysis of alternatives;
- Chapter 4: Policy, legislative and institutional framework;
- Chapter 5: Baseline description;
- Chapter 6: Stakeholder engagement;
- Chapter 7: ESIA assessment methodology;
- Chapter 8: Impact assessment;
- Chapter 9: Environmental and social management; and
- Chapter 10: Conclusion.

2.5 Project schedule

Table 1 summarises the key achieved or proposed milestones for the ESIA and the Project.

Table 1: Project ESIA Schedule

Activity	Date
Scoping	March 2023 (completed)
Consultation on national EIA	Late April 2023 (completed)
Submission of national EIA	05 May 2023 (completed)
Submission of draft ESIA	End of May 2023
Lender disclosure period	Aug-23
Finalise ESIA (including public consultation comments, Lender comments and ongoing studies)	Aug-23
EIA Approval	Aug-23
Financial close	Oct-23
Finalise LRP compensation obligations (pre-construction)	Aug-23
Finalize Project Company and EPC-ESMS (pre-construction)	Sep-23
Early Work program	Aug-23

Limited Notice to Proceed to EPC (site clearance and preparation works[2])	Sep-23
Construction Start (inverter Skid foundation, civil works, BESS)	Nov-23
1st Module Delivery at Site	Feb-24
Tracker and Module Mechanical Works	February 2024 to August 2024
Electrical works (switchyard and MCR)	February 2024 to August 2024
Commissioning	Jul-24
Early generation	Aug-24
Commercial Operation Date (FC plus 12 months)	Dec-24
Expected Lifetime	25 years (2024 to 2049) (BESS to be renewed after 10 years)

2.6 ESIA team and project contact information

Juru Energy Consulting Ltd. completed the ESIA study. The team of JE specialists involved in the Project is presented in Table 2. Team member CVs are provided in Volume III: ESIA Technical Appendix.

JURU ENERGY CONSULTING LLC, UZBEKISTAN
Name: Viktoriya Filatova, Zilola Kazakova
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Name: Khurshid Karamatov
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Email: kkaramatov@masdar.ae
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Table 2: ESIA Team

Name	Position
Nicola Davies	Project Manager & Environmental Expert
Caleb Gordon	International Biodiversity Expert
Marianne Lupton	International Social Specialist

[2] For clarity, early site mobilization includes the construction of the temporary site facilities, telecommunication equipment, worker welfare facilities, road improvements and site fencing. Works on the solar field (including clearance, levelling or any earthworks in the solar field) or any work on the energy production infrastructure of the PV plant is not considered early site works.

Viktoriya Filatova	Local Environmental Specialist
Anna Ten	Local Biodiversity Expert
Zilola Kazakova	Local Social/Resettlement Specialist
Timur Abduraupov	Local Herpetologist
Natalya Beshko	Local Botanist
Abdulhoshim Turgunov	National EIA Expert

3 Project Description

3.1 Needs case

Uzbekistan has abundant renewable energy resources (solar and wind) and renewable generation potential. This potential has remained virtually untapped due to a lack of incentives, experience, historically subsidised natural gas prices for the country's gas-fired thermal power plants that constitute over 80% of the total power generation capacity, and low tariffs.

The GOU aims to increase its renewable power supply and has adopted the 2030 Energy Strategy, which defines several objectives and directions for electricity supply. One of the Energy Strategy objectives includes developing and expanding renewable energy sources (RES) to at least 25% by 2030 (a total RES capacity of 10 GW) and its integration into the unified power system. To fulfil this objective, the GOU intends to "Ensure diversification in power and heat energy sectors through the increased share of renewable energy sources and creation of renewable energy investment project mechanism utilising PPP [public-private partnership] approaches, enhancement of government policies related to the development of renewable energy sources, demonstration of renewable projects". This strategy aligns with Uzbekistan's obligations under the Paris Agreement on Climate Change.[3,4] Expressly, the GOU has set a target to increase solar power production to five gigawatts (GW) by 2030.

In May 2019, the laws of the Republic of Uzbekistan, "On the use of renewable energy sources" and "On public-private partnership", were adopted, creating a regulatory and legal framework to accelerate the implementation of renewable energy projects such as this one.

The Nur-Bukhara PV and BESS Project is part of the Uzbek Solar 3 program, which aims to enable the rapid roll-out of competitively priced, utility-scale solar PV power in Uzbekistan through a largely standardised joint World Bank Group (World Bank, IFC and MIGA) solution based on a templated PPP transaction.

This Project wholly supports the objectives of the sustainable environmental energy policy described above, including:

- Reduce energy dependence on carbon-based fuels.
- Meet RES targets.
- Reduce greenhouse gas emission rates.

3.2 Analysis of alternatives

The alternatives considered for the Project are broadly categorised as listed and discussed in more detail below:

- No project alternative
- Options for alternative renewable energy generation

[3] Law of the Republic of Uzbekistan "On Ratification of the Paris Agreement" (No.ZRU-491 dated 02.10.2018).
[4] National Determined Contribution (NDC) is defined din updated NDC document 2021 Updated National Determined Contribution 2021

- Options for alternative sites
- Options for alternative PV technology

3.2.1 No project alternative ("do nothing")

Under the no-project alternative, the Project would not be constructed. If the Project is not built, the following benefits/ outcomes will not be realised:

- No direct capital investment in the area.
- Reduction in indirect socio-economic benefits (service providers).
- Reduction in tax revenues for the local economy.
- Reduced economic development and possibilities for improving the social welfare of people in the region.
- A slowdown in the diversification of energy generation in Uzbekistan resulting in a greater reliance on fossil fuels and wind power.
- Loss of 300 W of renewable power towards Uzbekistan's overall target of 10 GW.
- Displacement of CO_2 emissions as the energy production from the Project would substitute generation from fossil-fuelled fired generation plants in the short and medium term.

3.2.2 Technology alternatives

Uzbekistan is promoting an aggressive diversification strategy, including both wind and solar as such, wind energy could be considered a viable technology alternative to contribute to Uzbekistan's goal of 25% renewable generation by 2030. Table 3 compares wind energy versus solar energy and assumes that both technologies would employ an energy storage system in line with Uzbekistan regulations. The comparison highlights that while both offer many benefits, solar can be concentrated in a much smaller area and typically have lower ecological risks (if the site is well selected).

Regarding the selected site, this Site is not considered suitable for a wind project and across Uzbekistan, a country-wide screening and selection process to identify potential wind sites is ongoing. The proposed site was selected based on solar potential, and further discussion is provided in section 3.2.3 below.

Table 3: Comparison of wind and solar for achieving renewable targets

Technology	Advantages	Disadvantages
Solar	• Renewable technology- free fuel- with CO_2 emissions only considered with lifecycle assessment of equipment manufacture- no CO_2 emissions from general operations. • Typically, low maintenance. • Poverty-reducing benefits.	• Power is only possible during sunlight hours. • Relative inefficiency per square meter. • Generally, not seen as suitable for baseload power, given intermittent energy source. • Fewer employment opportunities compared to wind, hydroelectric and thermal power plants.

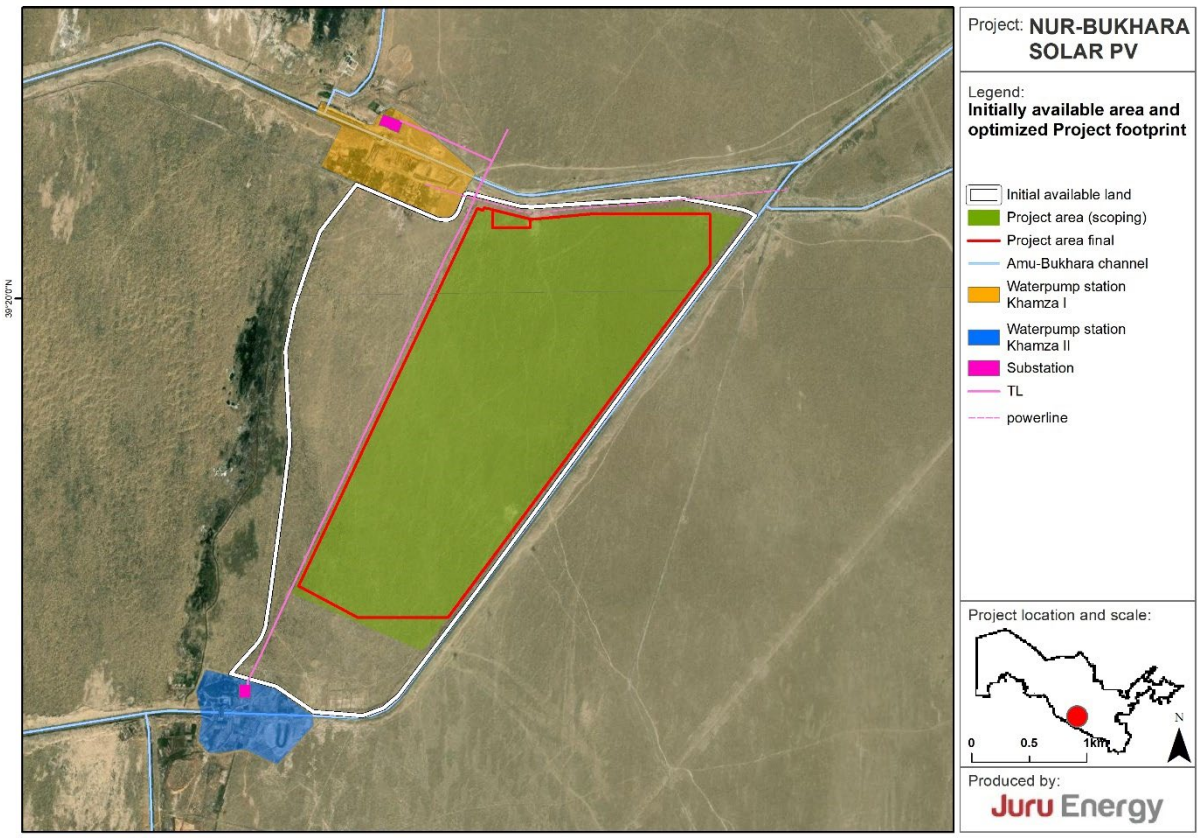
Technology	Advantages	Disadvantages
	• Recent technological advancements result in greater efficiency and lower costs.	• Panel efficiencies reduce over time (though typically, manufacturers offer maximum degradation guarantees) • It can be concentrated in relatively small areas of land. • Only site-specific impacts on biodiversity.
Wind	• Renewable technology- free fuel- with CO_2 emissions only considered with lifecycle assessment of equipment manufacture- low/no CO_2 emissions from general operations. • Contribute to Uzbekistan's goal of 25% by 2030. • Poverty-reducing benefits.	• Only suitable for areas with high wind intensity/regularity. • Dependent on the wind, allowing little scope for increasing power generation if needed: generally, not seen as suitable for baseload power given inconsistencies in generation. • Typically needs large areas of land. • Wind turbines are sometimes considered visually detrimental to the surrounding landscape. • Environmental impacts associated with bird and bat collisions are relevant in Uzbekistan.

3.2.3 Alternative sites and design/layouts – main site

It is understood that the Site was part of a more comprehensive country-wide site selection process undertaken by the GOU and supported by specialist consultants. As described in the Environmental and Social Scoping report – Bukhara Solar PV project (SP6890 – Uzbek Solar 3[5]), February 2022, prepared by TYPSA consulting on behalf of IFC (TYPSA scoping report), a screening exercise for site selection was performed that identified an original site area of 1036 ha (Figure 4). Following a review of E&S constraints, an optimised area (645 ha) (the current project area) was proposed for development. The key factors that informed the optimised site were the locations of the existing OHTL and the presence of sensitive receptors/constraints along the southern boundary. Earlier alignments of the Project layout included 2ha of land leased by Farmer F01 from the land management company "Alat Qoraqolchilik LLC". This land has now been excluded from the Project layout to eliminate land related impacts on farmer F01.

[5] The Uzbek Solar 3 program aims to enable the rapid roll-out of competitively priced, utility-scale solar photovoltaic (PV) power in Uzbekistan through a largely standardized joint World Bank Group (World Bank, IFC and MIGA) solution based on a templated Public Private Partnership (PPP) transaction.

Figure 4: Initially available area and optimized Project footprint (extracted from the TYPSA scoping report, 2022)



The decision to connect the Project directly to the existing OHTL running along the updated western boundary (see section 3.2.4 below) further supported the final OHTL optimisation and reduced the E&S impacts associated with having a dedicated new OHTL for grid connection. The sizing of the Project has been carried out with the following criteria in mind:

- Maximize the occupied area, respecting the minimum required easements and distances;
- Maximize annual power generation;
- Optimization of cabling lengths; and
- Optimization of earthworks and trenches that directly affect the ground.

3.2.4 Alternative sites and design/layouts - grid connection

One of the most significant E&S constraints when developing a solar project can be the grid connection. The initially proposed interconnection solution was through the extension of the existing electric substation Khamza-2, located close to the south-west boundary of the site and a direct aerial connection between the Project and the substation (approximately five kilometres to the northwest) (TYPSA scoping report).

Following a more detailed technical, financial and E&S review, the solution was revised to enable a connection directly to the existing 220 KV OHTL that crosses the original 1036 ha project area, with the point of interconnection being 30 m from the boundary of the current Project site. This also represents the optimum solution from an E&S perspective, as this does not require

constructing an additional OHTL line outside the PV site footprint or extension of the Khamza-2 substation (TYPSA scoping report).

Considering the proximity to the grid connection, no further optimisation studies have been performed regarding this solution by Masdar.

3.2.5 Alternative technology - solar PV panels

The initially proposed project considered the development of 250 MW_{AC} of solar PV only. During the development phase, a BESS was added to comply with Uzbekistan's national regulations.

Water scarcity is a widespread problem in most regions of Uzbekistan. In this context, water supply and the optimal use of water resources for the PV plant were considered significant. The water need and availability were critical considerations in selecting the PV panel. Typically, cleaning schedule optimization and dry-cleaning methods are preferred to minimize the annual volume of water used for panel cleaning during the operation phase (TYPSA Infrastructure Report). Masdar considered several panel cleaning systems, including wet and dry-cleaning systems, before settling on a dry-cleaning solution representing the most resource-friendly option.

For this Project, bifacial photovoltaic modules based on half-cut monocrystalline silicon technology, widely proven in numerous facilities worldwide, have been selected. Monocrystalline silicon offers high efficiency and good heat tolerance characteristics with a small footprint. Polycrystalline technology has lower efficiency and no other significant E&S advantages over monocrystalline, e.g., recyclability. The main advantage is that they are generally cheaper. The monocrystalline option was selected as the optimum solution for this site.

To optimize the available surface area, an independent row one-in-portrait (1P) tracker has been selected. Compared to a multi-stack tracker, the advantages of this system are less maintenance of the PV Plant and greater flexibility of implementation.

3.2.6 Alternative water supply options (construction and potable water needs)

Different options for water supply were investigated for feeding into the panel selection but also for construction water and potable water supply (see Table 4). The review's outcome did not reveal an obvious, sustainable water source nearby which strongly influenced the selection of dry-cleaning PV technology (as described above) and the use of the municipal water supply to tanker water to the site for all other purposes.

Table 4: Summary of water supply options and suitability for the Project (source: TYPSA Infrastructure Report)

Option	Suitability for the Project	Conclusion
Existing water pipelines	Consultations conducted by the TYPSA team with the Sanitarian Agency Epidemiological Peace and Public Health and the Water Supply Organization confirmed no potable water pipelines in the area.	As water use (especially during operation) will be small and for a short period. The option to construct a long pipeline connected to the existing municipal system was not selected.

Option	Suitability for the Project	Conclusion
Municipal water supply (potable and construction)	Volumes of water required on-site can be tankered to the site from a sustainable municipal water supply (refer to water resource impact assessment for further analysis).	This option was selected for implementation at the site.
Amu Bukhara Irrigation System (ABIS canal)	Water from the canal could be used during the construction and operation phases of the PV plant. According to a representative of the Alat Khokimiat, the project water needs may be included in district water needs and agreed with the local Irrigation System Authority, but this was not confirmed. Water quality is also unsuitable for drinking, so an additional water treatment plant would be required on-site.	Considering the water quality and the sensitivity of other water users, this option was deemed too significant a burden on the overall water resource and cost prohibitive to treat. This option was not selected.
Drainage ponds (west of the site)	Water is saline and would require water treatment for cleaning potable consumption.	This option was considered cost prohibitive, and it noted that the ponds have some ecological function. This option was not selected.

3.3 Project location and setting

The Project site ("Site") is a 645 ha trapezoid-shaped site surrounded by the ABIS canal to the North, South and East. The Site is approximately 24 km South of Alat City and about 25 km from the border with Turkmenistan. Two main communities are close to the Project site, Kirlishon (10 km) and Kulchovdur (11 km), with about 2,000 and approximately 700 residents, respectively (see **Error! Reference source not found.**Figure 14). The site is adjacent to national road R78 on the north. The Amu Bukhara Irrigation System (ABIS canal) borders the site to the north, east, and south. One ABIS canal runs along the entire eastern border of the Project site; another canal runs E-W just north of the northern border of the Project site; and another canal runs westward just south of the southern border of the Project site. Roughly one kilometre west of the Project site, a narrow corridor of small saline ponds and ephemeral water drainage channels exist in a north-south orientation. Key reference features are summarised in Table 5.

Table 5: Key reference features of the site

Sl. No.	Particular	Description
1.	Site location	Bukhara, Uzbekistan
2.	Coordinates	Latitude: 39°20'23.47"North Longitude: 64° 4'45.49" East Universal Transverse Mercator (UTM) coordinates (Zone 41)
3.	Maximum temperature	45.8 °C
4.	Minimum temperature	-23 °C
5.	Design ambient temperature	-20°C to 45 °C
6.	Maximum wind speed	39 m/s
7.	Relative humidity	90 %
8.	Average rainfall	300 mm per year
9.	Corrosion category	C3
10.	Maximum altitude	232 m

The Site is relatively flat, with a slight slope towards the Southern direction in the upper parts of the Site with predominantly bushy shrubs. There are remnants of dismantled OHTL tower footings from an OHTL that used to cross the site (refer to **Error! Reference source not found.**).

Figure 5: Sandy desert on the Project site

Figure 6: Calligonum bushes on the Project site

Figure 7: Fixed fine-hummocky sands

Figure 8: Areas of weakly fixed hummocky sands

Figure 9: Looking south - unpaved road along the ABIS canal (within the 70m buffer zone between the ABIS canal and the fenceline)

Figure 10: Looking west - remains of the OHTL foundations on the Project site (existing OHTL in the background)

Figure 11: Asphalt road and existing OHTL along the western border of the Project site

Figure 12: ABIS canal

Figure 13: Historical gypsum quarry within the Project site footprint

Figure 14: Wider Project area

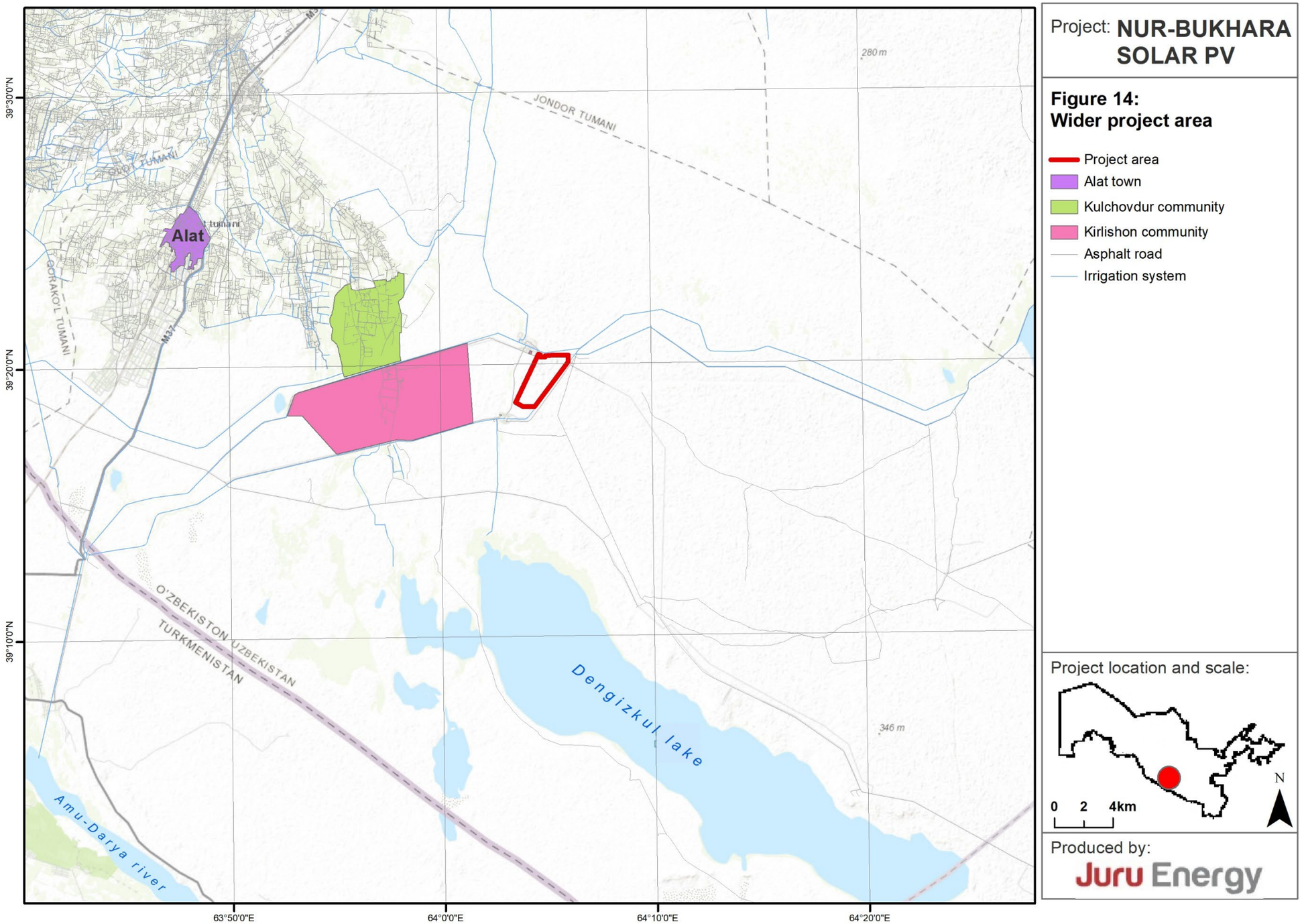


Figure 15: Project setting (map view)

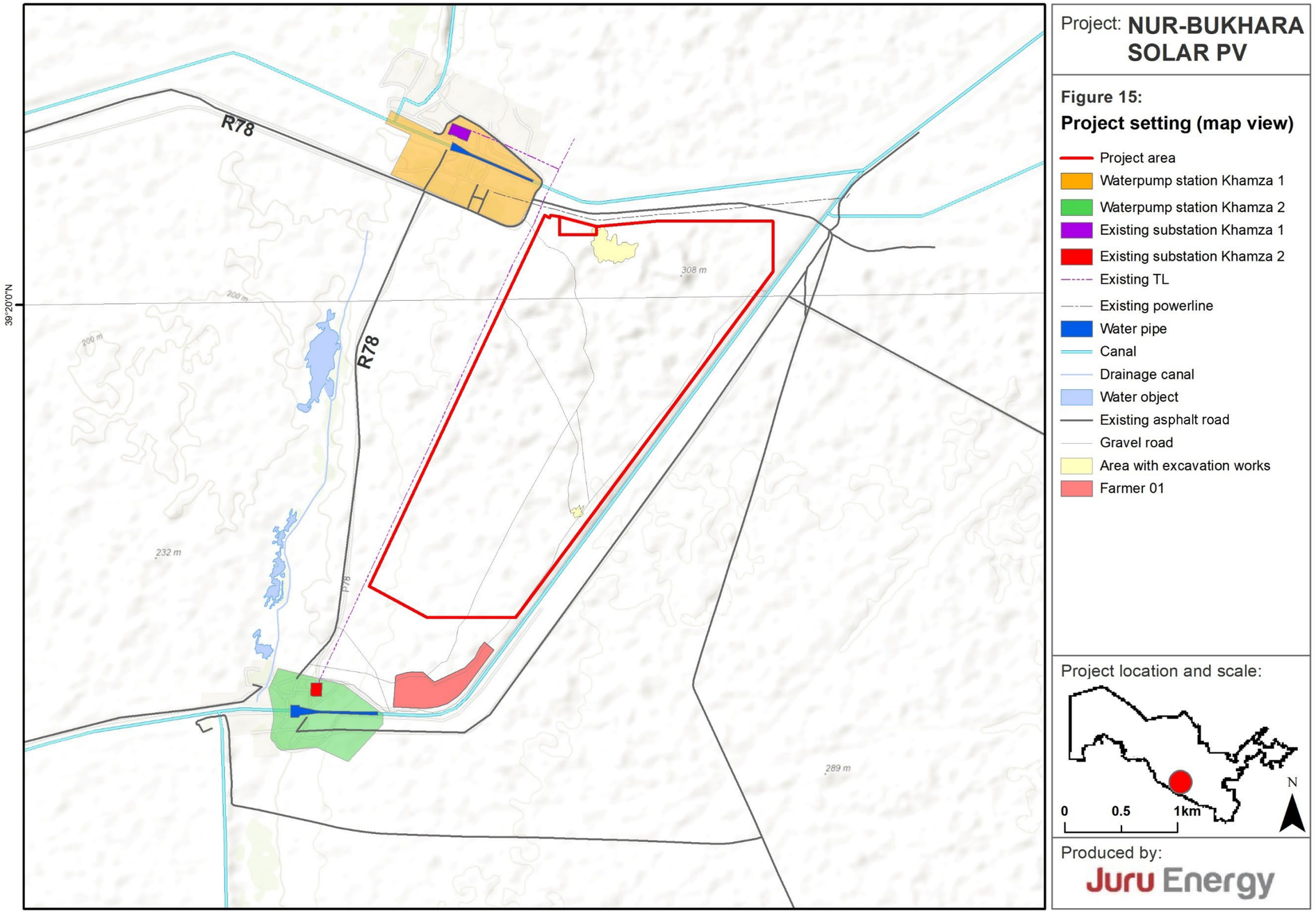
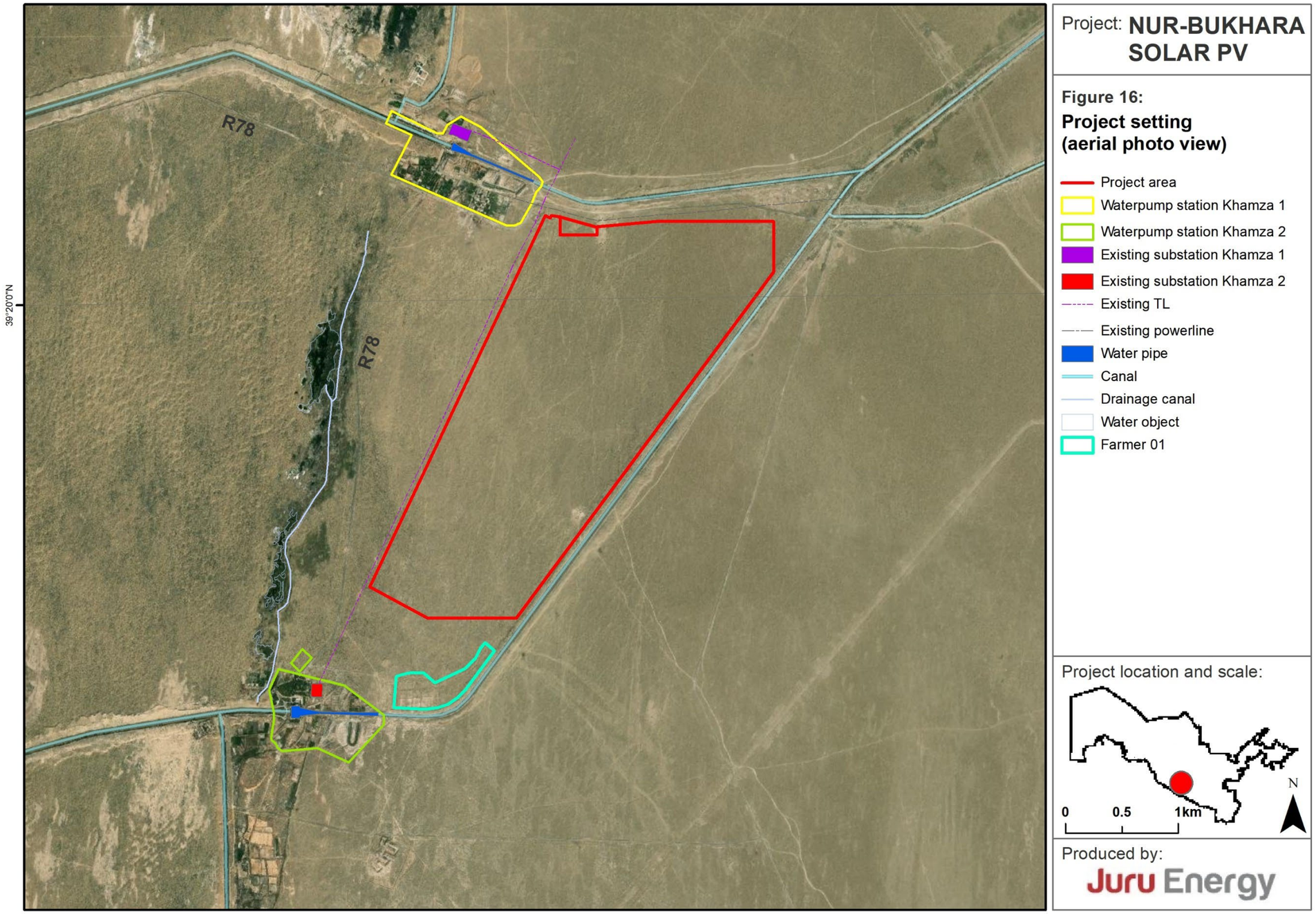


Figure 16: Project setting (aerial photo view)



3.4 Project receptors

Project receptors are illustrated in Figure 17. In addition to residents of the Kirlishon and Kulchovdur communities, there is a small community within the existing Khamza 1 substation compound comprising eight households (there are about ten houses, but not all are inhabited). These people originate from and are considered part of the Kirlishon community. A worker accommodation camp within the Khamza 1 compound is also used by workers from China National Technical Import and Export Corporation (CNITTC) for construction works on the Khamza 1 substation.

CNITTC is engaged in reconstruction activities at the Khamza-1 pumping station located approximately 850 m from the Project boundary. Reconstruction works started in 2019 and are expected to last until Q4 of 2024. The Khamza-2 water pumping -station (approximately 800 m from the Project boundary) is being renovated by China National Nuclear Corporation ("CNNC"), and the renovation works are expected to be completed in Q4 of 2023. A batching plant is located opposite the Khamza-2 water pumping station, approximately one kilometre from the Project boundary.

A temporary workers' accommodation is located near the Khamza-2 substation and accommodates approximately 70 Uzbek workers and 40 Chinese workers from Khamza-2 substation. They are located in a walled area just outside the southern part of the Project footprint.

Although no seasonal herders were seen to be using the Project footprint, herders have permission to use the area during spring. A herder and his partner (H1 and H2) have a 10 month LLA to use the land of the Project site least from "Alat Qoraqolchilik LLC" (the company that manages the land). This land will be impacted by the Project[6]. Four herder camps were identified in the area surrounding the Site. It is understood that these camps are only used during certain times per year from March to October[7]. None of the camps will be impacted by the Project. Up to eight herders may separately use the site at any one time.

One farmer has a lease agreement to farm 20 ha of land outside the southern border of the project footprint (Shaxram omad LLC farm). He uses approximately 4 ha for agriculture, and the remainder of the land for grazing 30-40 cows between March and June. The Project area has been modified so that his land will not be impacted. The farmer has a stable on his land, outside the proposed Project Site.

Two areas on the Project site have been subject to historical small-scale gypsum quarrying activities but have not been used for some time (marked as 'area with excavation works' in Figure 15. This appears to be surface quarrying comprising removal of earth for local supply of gypsum and these areas are excluded from PV layout but will remain within the site boundary.

A structure to the South of the Project Site is not being used but is owned by the Khamza 2 substation.

[6] Further information on land use and receptors is provided in ESIA Volume VI: LALRP.

[7] For example, the camp located south-east of the Project site, which belongs to Shaxram omad LLC farm, is used from March to July

Based on interviews, some people were identified as fishing in the canal. Khamza 1 and 2 substations (including the worker accommodation and the village members) and the small settlement of Kirlishon community (near Khamza 1) reported using water from the canals for drinking, construction, and irrigation as this village is not connected to the mains potable water system. This water use is informal and not undertaken in agreement with the canal authorities.

3.5 Project layout

The Project boundary and layout are illustrated in

Figure *18* and Figure 19.

Figure 17: Receptor map (project site and direct area of impact)

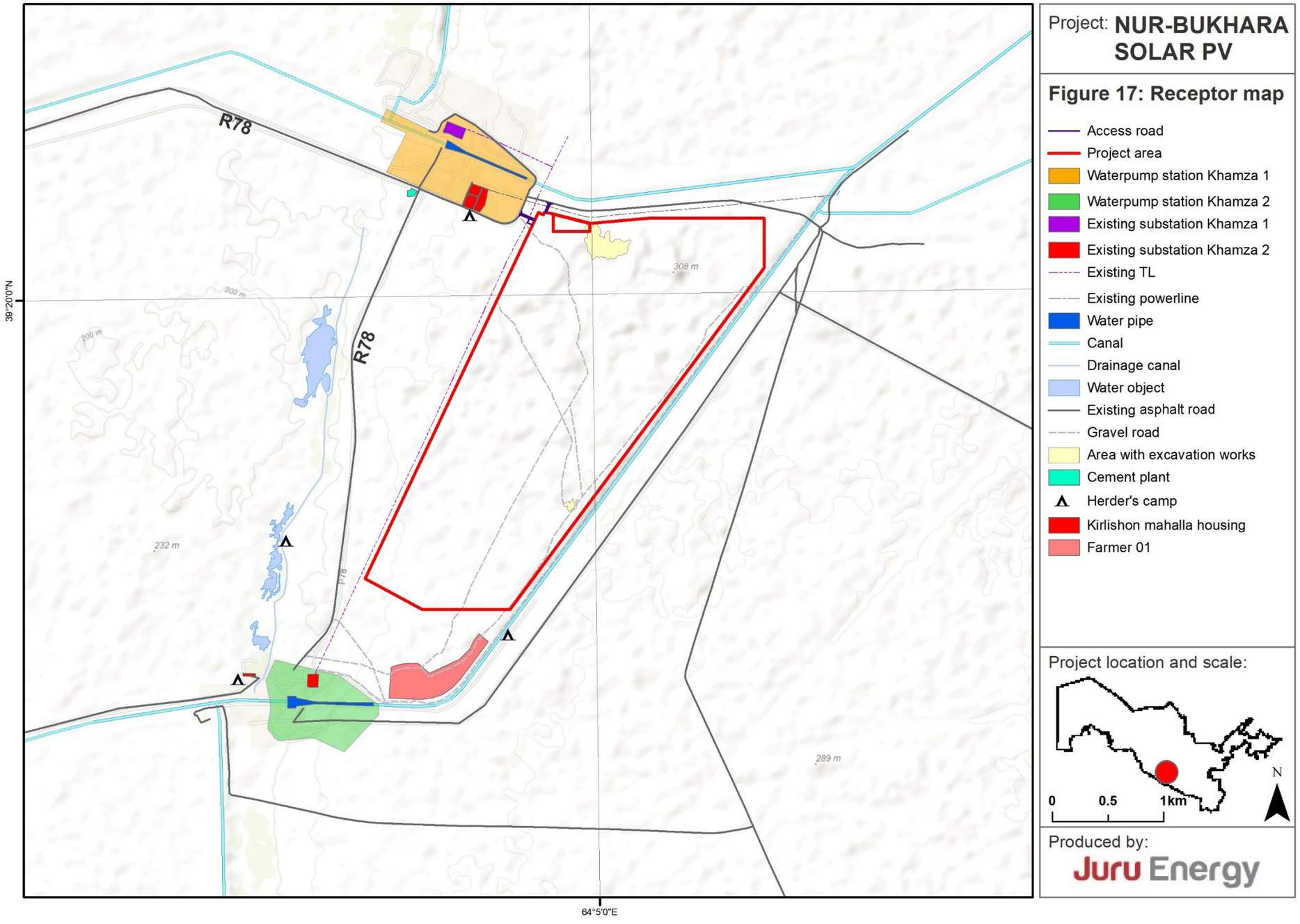
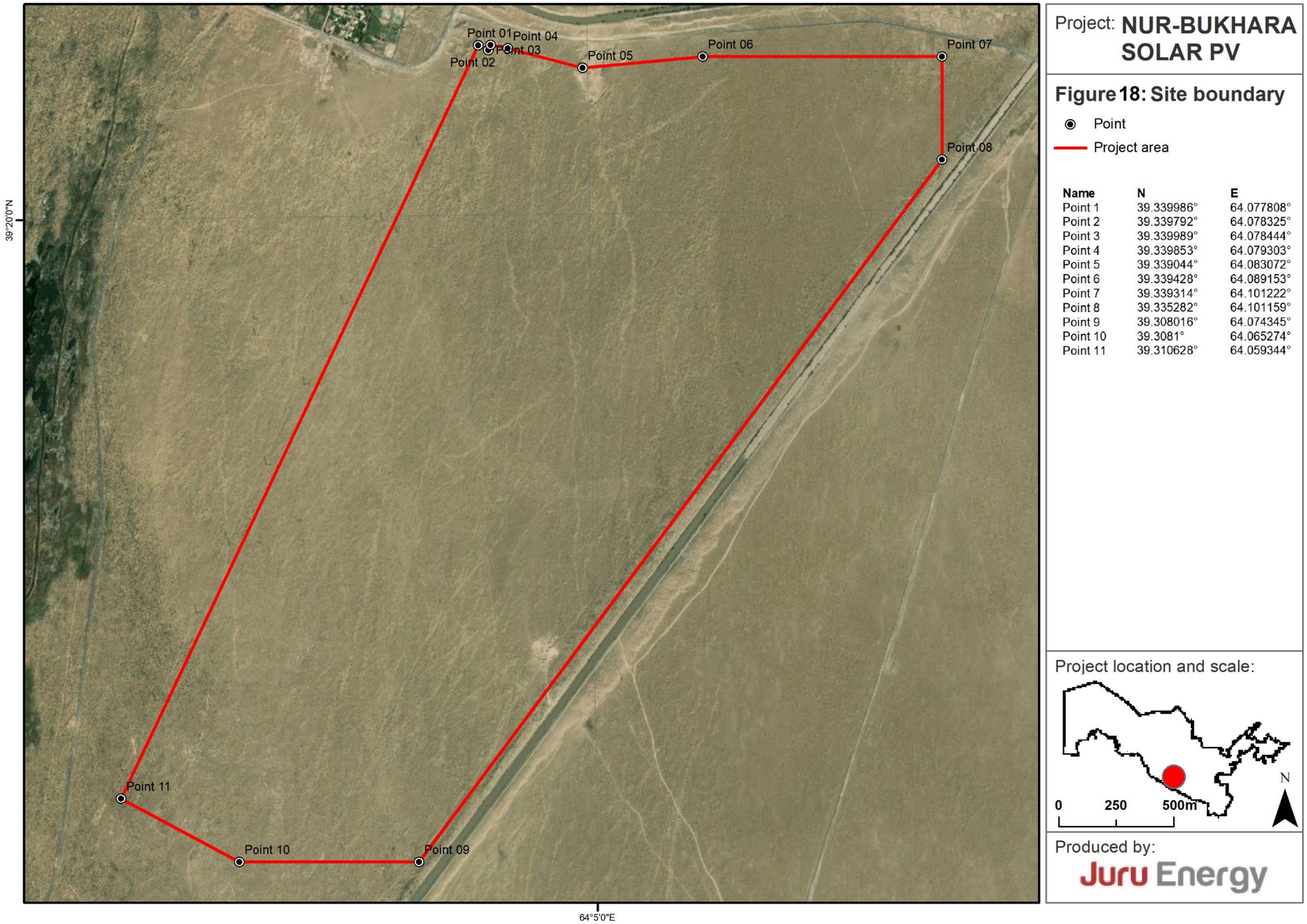


Figure 18: Site boundary



Project: **NUR-BUKHARA SOLAR PV**

Figure 18: Site boundary

Point

Project area

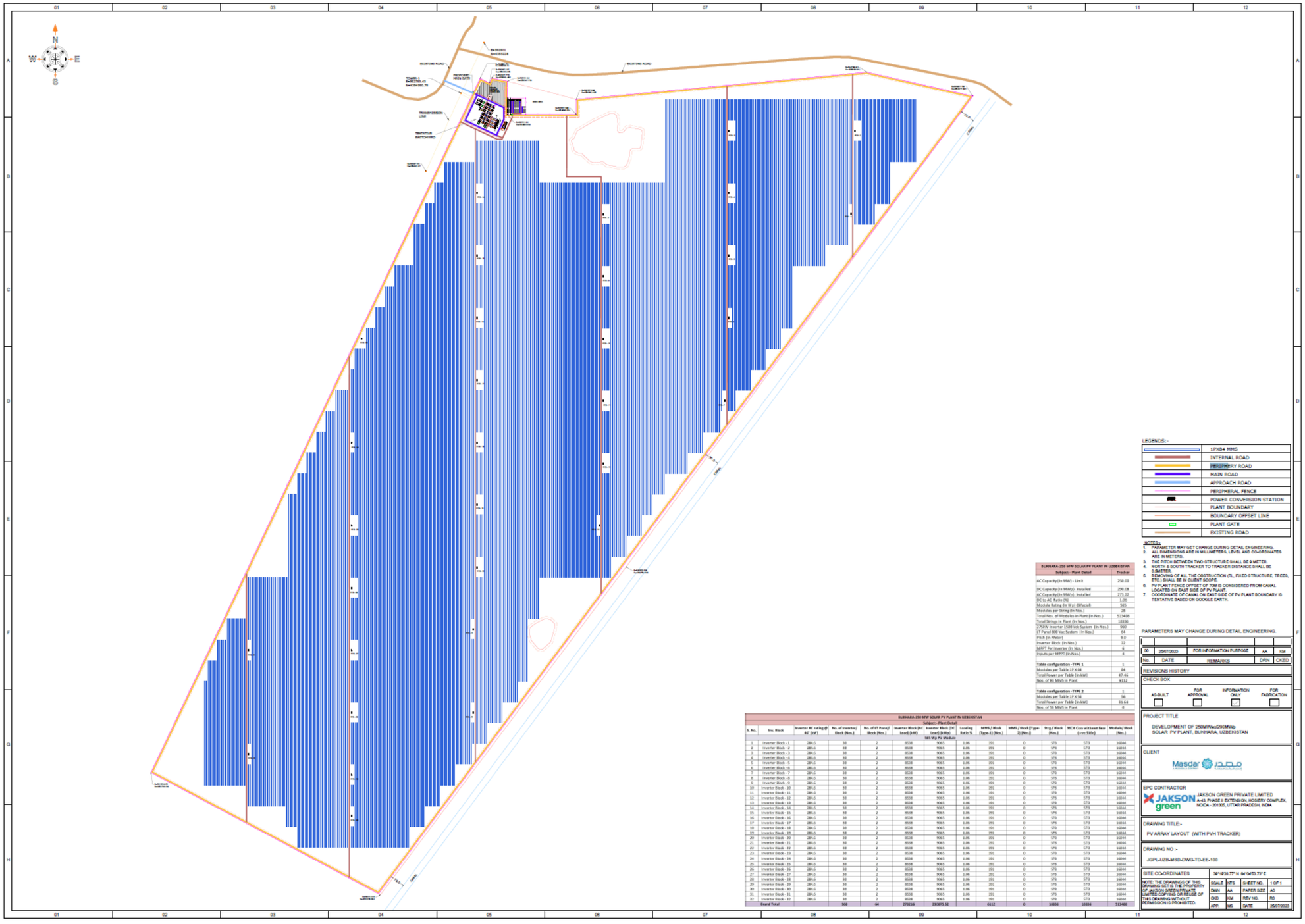
Name	N	E
Point 1	39.339986°	64.077808°
Point 2	39.339792°	64.078325°
Point 3	39.339989°	64.078444°
Point 4	39.339853°	64.079303°
Point 5	39.339044°	64.083072°
Point 6	39.339428°	64.089153°
Point 7	39.339314°	64.101222°
Point 8	39.335282°	64.101159°
Point 9	39.308016°	64.074345°
Point 10	39.3081°	64.065274°
Point 11	39.310628°	64.059344°

Project location and scale:

Produced by:

Juru Energy

Figure 19: General configuration of PV plant with battery storage



BUKHARA-250 MW SOLAR PV PLANT IN UZBEKISTAN

Subject- Plant Detail	Tracker
AC Capacity (In MW) - Limit	250.00
DC Capacity (In MWp)- Installed	290.08
AC Capacity (In MWp)- Installed	273.22
DC to AC Ratio (%)	1.06
Module Rating (In Wp) (Bifacial)	585
Modules per String (In Nos.)	28
Total Nos. of Modules in Plant (In Nos.)	513408
Total Strings in Plant (In Nos.)	18336
275KW Inverter 1500 Vdc System (In Nos.)	960
LT Panel 800 Vac System (In Nos.)	64
Pitch (In Meter)	9.0
Inverter Block (In Nos.)	32
MPPT Per Inverter (In Nos.)	6
Inputs per MPPT (In Nos.)	4
Table configuration - TYPE 1	1
Modules per Table 1P X 84	84
Total Power per Table (In kW)	47.46
Nos. of 84 MMS in Plant	6112
Table configuration - TYPE 2	1
Modules per Table 1P X 56	56
Total Power per Table (In kW)	31.64
Nos. of 56 MMS in Plant	0

BUKHARA-250 MW SOLAR PV PLANT IN UZBEKISTAN

Subject- Plant Detail

S. No.	Inv. Block	Inverter AC rating @ 40° (kW)	No. of Inverter/ Block (Nos.)	No. of LT Panel/ Block (Nos.)	Inverter Block (AC Load) (kW)	Inverter Block (DC Load) (kWp)	Loading Ratio %	MMS / Block (Type-1) (Nos.)	MMS / Block (Type-2) (Nos.)	Strg./ Block (Nos.)	MC4 Connection Face (+ve Side)	Modules/ Block (Nos.)
					585 Wp PV Module							
1	Inverter Block - 1	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
2	Inverter Block - 2	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
3	Inverter Block - 3	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
4	Inverter Block - 4	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
5	Inverter Block - 5	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
6	Inverter Block - 6	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
7	Inverter Block - 7	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
8	Inverter Block - 8	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
9	Inverter Block - 9	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
10	Inverter Block - 10	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
11	Inverter Block - 11	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
12	Inverter Block - 12	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
13	Inverter Block - 13	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
14	Inverter Block - 14	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
15	Inverter Block - 15	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
16	Inverter Block - 16	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
17	Inverter Block - 17	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
18	Inverter Block - 18	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
19	Inverter Block - 19	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
20	Inverter Block - 20	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
21	Inverter Block - 21	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
22	Inverter Block - 22	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
23	Inverter Block - 23	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
24	Inverter Block - 24	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
25	Inverter Block - 25	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
26	Inverter Block - 26	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
27	Inverter Block - 27	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
28	Inverter Block - 28	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
29	Inverter Block - 29	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
30	Inverter Block - 30	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
31	Inverter Block - 31	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
32	Inverter Block - 32	284.6	30	2	8538	9065	1.06	201	0	573	573	16844
	Grand Total:	9110	64	273174	290075.52	6112	0	18336	18336	513408		

3.6 Land ownership status

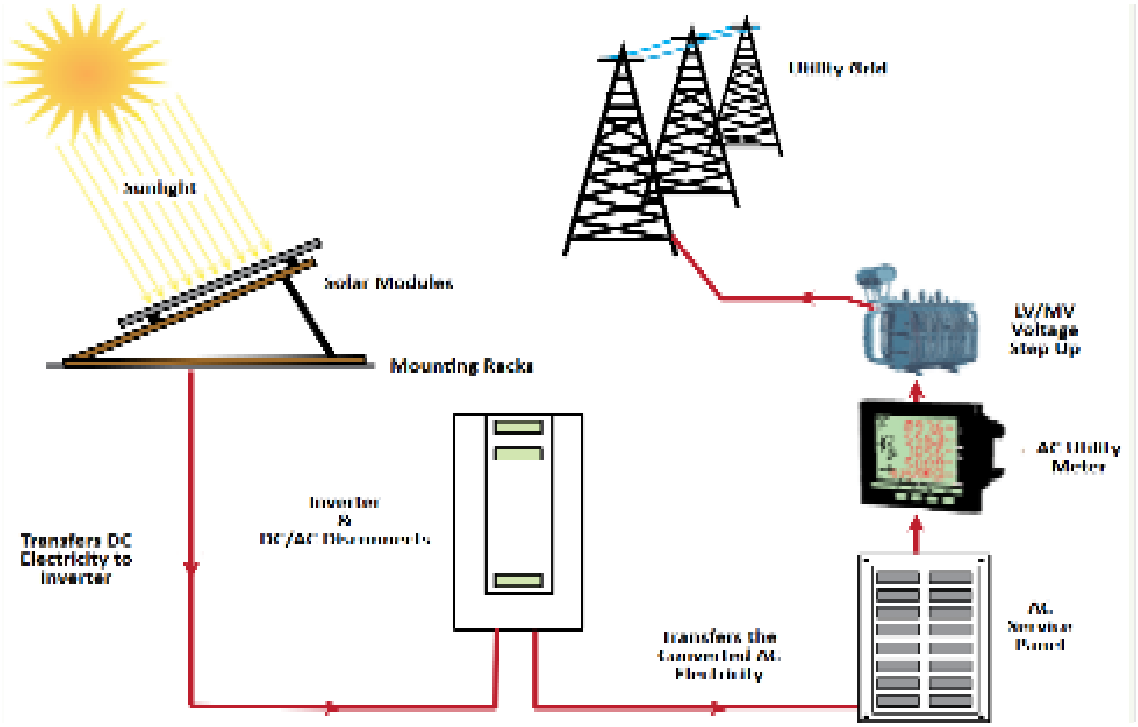
The allocated Site will be provided to the Project via a Land Lease Agreement (LLA) between Nur Bukhara LLC and NEGU. The land is currently leased by the State Committee for Sericulture and Wool Industry Development (SWID), which can provide LLAs to limited liability companies (LLCs) to farm the land or use it for grazing purposes. The land is leased by a government entity called Buhoro Karakol Cluster LLC which has the responsibility to manage the pastureland and sublease it. The land is then subleased to Alat Qorakolchilik LLC for 49 years. It is an entity which is also within the state framework of the wool industry development program. Alat Qorakolchilik LLC, pays either land tax or a fee according to the agreement to Buhoro Karakol cluster LLC. In addition, a herder and his partner have formal land rights granted for 10 months by "Alat Qoraqolchilik LLC" to graze land required for the Project. For further information on land use, see section 8.12.

3.7 Project components

3.7.1 Overview

Photovoltaic (PV) power uses solar panels to convert sunlight into electricity by converting solar radiation into direct current (DC) electricity. PV inverters convert the DC to AC and route it to small transformers that will raise the voltage from low voltage (LV) to medium voltage (MV). Then, the energy generated will be conducted through an underground medium voltage (MV) network of 35 kV to the 35/220 kV Substation. The voltage is raised again at the 35/220 KV substation to connect to the main grid system. An overview of the process is illustrated in Figure 20.

Figure 20: Overview of the PV process (compiled from IFC, 2015[8])



[8] IFC 2017, Utility-Scale Solar Photovoltaic Power Plants, A project developer's guide

3.7.2 Primary component - PV Plant

A description of the primary components of the PV Plant is provided in Table 6.

Table 6: Description of PV Plant components

Project components	Summary description
Photovoltaic (PV) panels	Bifacial photovoltaic modules based on half-cut monocrystalline silicon technology will be used. Approximately 513,582 modules across about 18,342 strings (~28 modules per string) will be laid out as shown in Figure 19 for a total nameplate capacity of 290MWp. Each module is approximately 2.3m x 1.2m (see Figure 22).
Trackers	The modules will be set on a horizontal (north-south) single axis trackers to track the sun's position. The structure of the trackers will be installed employing direct driving techniques to the ground whenever possible to a minimum depth determined by the geotechnical studies. Only if direct driving is not possible will a pre-drilling method be used. The expected foundation depth will be 1.5 to 2 meters.
Inverters and transformers	To be able to inject the DC generated by the modules into the electrical grid, it is necessary to transform it into an AC of similar conditions to that of the grid. Inverters convert the DC electricity produced by PV arrays into AC electricity compatible with utility grids. In addition, PV inverters often provide system protection and data communications. A total of 927 inverters will be installed and routed to 31 low to medium voltage transformers. The LV caballing runs along the back of the panels.
Low Voltage (LV) electrical Installation	The low voltage electrical installation is considered to refer to the downstream of the LV/MV transformers located in each of the small transformers of the Solar PV Plant. It is the connection between PV modules on each string, between strings and string inverters and the inverters and the low voltage panel of the power station.
Medium voltage (MV) (35kV) internal cabling	The MV power station comprises the MV cells and the power transformer, which is responsible for raising the output voltage of the inverters (800 V) to 35 kV. An MV (35kV) ungrounded power network connects the MV transformers with the 35/220 kV Substation. The MV cables will run in trenches (directly buried or under a tube, depending on the section).
Control System	The PV Plant's monitoring and control system will be based on open products on the market and will include the SCADA and the Plant's control system, as well as all the necessary equipment to communicate with the rest of the Facility's systems.

Figure 21: PV panels

Figure 22: PV tracking system and inverters (Single-axis trackers follow the sun east-to-west on a single point)

Figure 23: Battery container (internal)

Figure 24: Typical container BESS (external)[9]:

A summary of the PV and BESS systems is provided in Table 7 below. These components are sourced and provided to the EPC by Masdar.

[9] https://energycentral.com/c/cp/large-battery-energy-storage-systems

Table 7: PV plant and BESS configuration

Elements	Parameter	Unit	
PV plant Configuration	Peak Power of Modules	MWp	290,043
	Apparent Power of Inverters (at 45 ºC)	MVA	285,516
	Access Capacity	MW	250.0
	DC/AC Ratio (installed P. /. Access C.)	-	1.01 / 1.16
	Number of inverters	Ud.	927
	Number of modules	Ud.	513,352
	Number of strings	Ud.	~18,000
	Number of structures 1P x 84/56	Ud.	6,153
	Number of modules per string	Ud.	28
	Pitch	m	9
BESS System Configuration	AC power	kW	63,000
	AC Installed Power	kWh	126,000

3.7.3 Primary components - Battery Energy Storage System

Battery energy storage systems (BESS) can help address the intermittency of solar power and enable a power system to respond rapidly to large fluctuations in demand, making the grid more responsive and reducing the need to build backup power plants.

A BESS is a set of energy accumulators that can store electrical energy through an electrochemical process. The BESS consists mainly of batteries and a battery control and monitoring system (BMS). As depicted in Figure 25, the smallest, indivisible battery unit is called a cell, within which chemical reactions occur. Cells are connected within modules. These modules are equipped with voltage, current and temperature sensors to monitor the state of the cells. The modules, in turn, are connected inside cabinets, commonly called battery racks, until the desired system DC voltage level is reached at the design level. The battery racks also contain additional control and protection module. The BMS monitors the primary variables, such as voltage, current and temperature, at the level of the modules included in the rack and the cell. The stored power is transformed when needed by the power conversion system in the form of DC by the batteries into AC and vice versa by executing the appropriate current control to discharge and charge the batteries.

The BESS will consist of:

- A power conversion system (PCS) suitable for outdoor installation on a user-furnished concrete pad or the user-furnished box pad.
- Lithium-ion (Li-ion) battery with a design life expectancy rating of ten years under site operating conditions, suitable for outdoor installation, and a BMS. Any replacement/modification required to meet warranty requirements or design life shall be included.
- An Energy Storage Unit.
- DC Cables.
- Instrumentation and communication cables.
- Interfacing to meet statutory requirements and comply with Local Grid Code. All required hardware (AI & DI Cards).
- Fire Detection & protection system.
- HVAC system for BESS.

The BESS, and associated equipment, shall be provided in self-contained National Electrical Manufacturers Association (NEMA) enclosure(s) rated for the Site conditions with adequate ventilation and multiple layers of protection. Hazard and fire protection includes gas extinguishing methods using Fire Protection Fluid and water or a liquid Fire Fighting (Suppression) System) (FFS) along with sensors for the detection of the combustible gas like hydrogen or carbon monoxide in the ventilation system from the BESS. The FFS includes smoke detector, control panel, alarm device, exhaust pipe and bump head. It uses clean fire suppression gas to minimize the second loss.

The BESS will comprise four 40 ft containers with up to 3.32 MWh modular containers. The original equipment manufacturer (OEM) provided thermal conditioning systems shall maintain the ambient temperature within warranty requirements to minimise the chance of fire spread or thermal runaway. The BESS components and associated ancillary equipment shall have working space clearances required by local code, and electrical circuitry shall be within weatherproof enclosures marked with the environmental rating suitable for the type of environment in compliance with NFPA 70. All BESS containers will be locked to prevent unauthorised access.

The areas between and around equipment will be finished with gravel and kept free of vegetation or other material that could act to spread a fire. The Project will have a dedicated emergency plan in place.

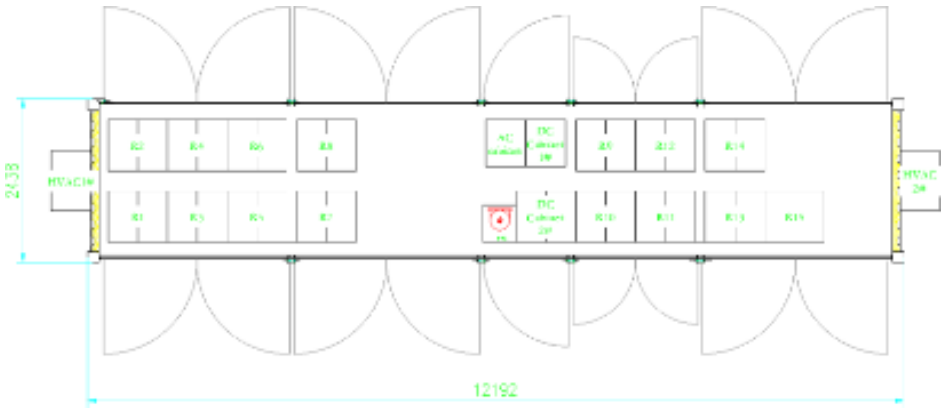
The operational period of each battery is 10 years; after this time the batteries will be replaced with the old batteries and returned to the manufacturer for recycling.

These BESS components are sourced and provided to the EPC by Masdar.

Figure 25: A: Battery cell (175×27×200mm), B: Battery Pack (contains 40 battery cells), C: Battery Cluster (contains 18 battery packs).

There are 15 battery clusters in one battery container, as per Figure 26.

Figure 26: Typical BESS container



3.7.4 Substation and grid connection

The Project air-insulated substation will transform the generation and BESS's output voltage levels to the utility one (220 kV) through two power transformers for the PV generation and another for BESS and the associated electrical devices. The arrangement shall be a single busbar with three transformer bays, two-line bays, three power transformers, and indoor MV and LV systems. Medium voltage switchgear shall be indoor, gas insulated (GIS) type and with the required functions (transformer, feeders, auxiliary services, capacitor bank, etc.). The substation shall have a control building incorporating the following systems:

- MV switchgear;
- Protection and control panels;
- AC/DC auxiliary power supply panels;
- DC battery banks (in a separate room) and chargers;
- MV/LV transformer for supplementary services;
- Telecom panels; and
- Other rooms (offices, warehouse, toilets).

The Project substation will connect to the existing OHTL, "Karaku'l 500 SS" - "Hamza-2 SS" (see Figure 29) from the Project 35/220 kV Substation via a short (approximately 30 m) 220 kV Line-in-Line-Out (LILO) connection. The connection will include the following activities:

- One new lattice transition tower within the existing ROW alignment.
- Like for like replacement of the existing conductor between new tower and the nearest towers to the north and south (damaged during construction) (total 300 m of replacement line).

Although the connection distance is short, approximately 300 m of new OHTL infrastructure (150m) either side of the connection point). About 300 m of existing conductor will be restrung to enable the new LILO link to be made.

The connection from the substation to the existing OHTL extends approximately 10 m outside the boundary of the Project Site and does not require a new right of way (ROW) to be established for this short connection system. There is no additional affected land and / or and users other than already contemplated for the solar PV site (refer to section 8.12).

No expansion to the existing ROW is required for the new tower and replacement of the conductor within the current ROW. Setback requirements as per national law will be maintained. The interconnection system will incorporate protection, control and communication equipment meeting national and international standards. Construction and operational impacts are addressed in the sections below under general construction related impacts.

3.7.5 Access road and internal roads

The access to the PV Project from Bukhara city uses the M37 highway, which connects Bukhara and Alat cities. From Alat city and the R-78 regional road, an asphalt road in good condition connects Alat city to Muborak District, which runs along the site's northern boundary. The Project will require a new junction with the (R78) shown in Figure 27. Approximately 50 m of paved access from the new junction to the substation compound will be constructed. This land is owned by SWID and within the same land lease agreement as the remainder of the Project site, there will be no additional land impacts as a result of the access road construction. A second access from the South may also be established if required for emergency or other purposes (a full assessment of this road access will need to be undertaken, should it be determined as being necessary).

Figure 27: Existing R78 (photo)

The proposed internal road layout uses north-south oriented internal (unpaved gravel) service roads (4 m wide) to access the different inverters and areas of the PV plant and a few east-west internal service roads. The total length of the internal road network is approximately 41 km (refer to Figure 30).

3.7.6 Associated facilities

No associated facilities, as defined by IFC PS1, are identified for this Project.

Figure 28: BESS site layout and substation area (also showing primary gate access)

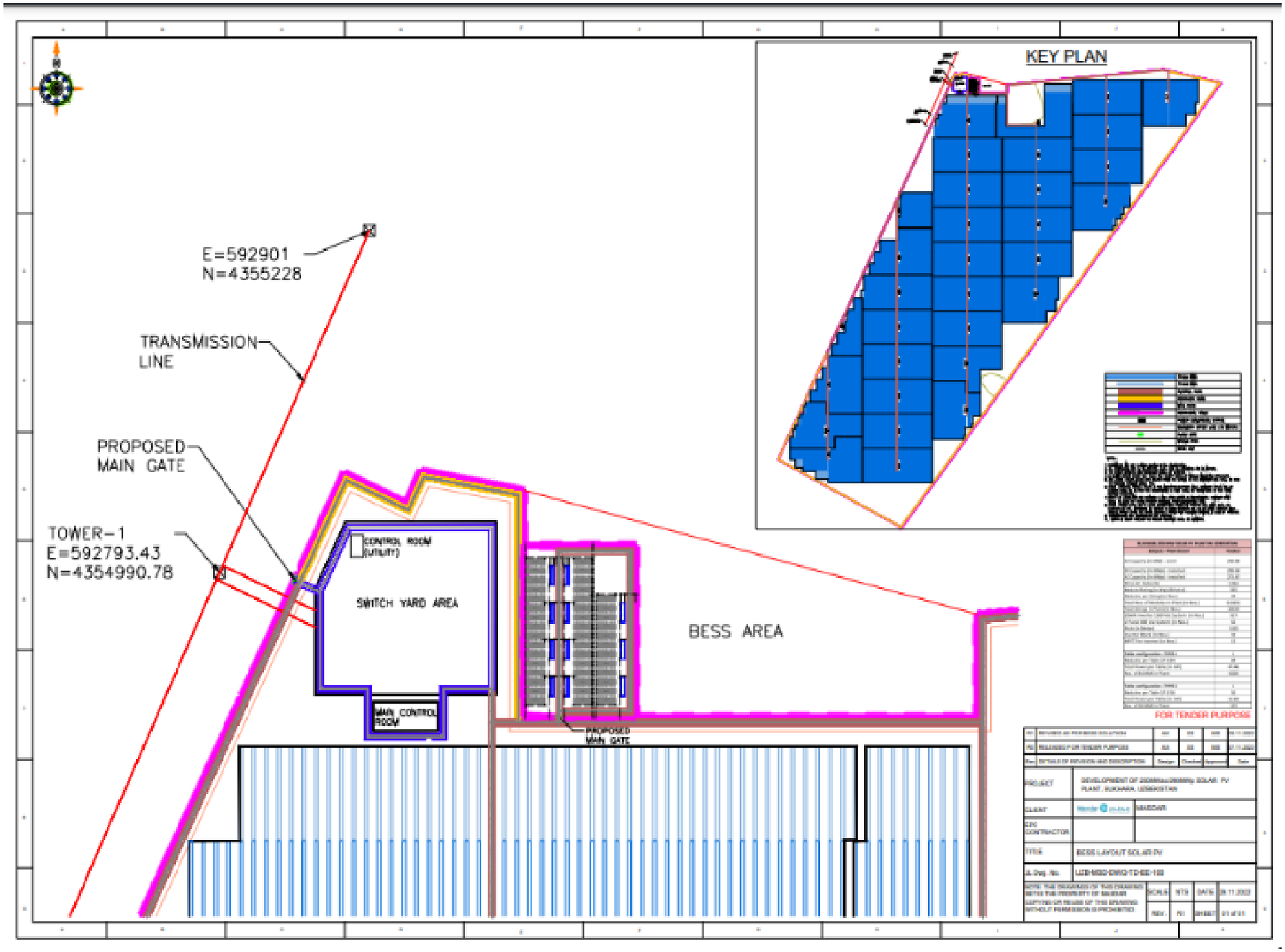


Figure 29: OHTL interconnection, substation layout (source TYPSA Scoping Report 2021)

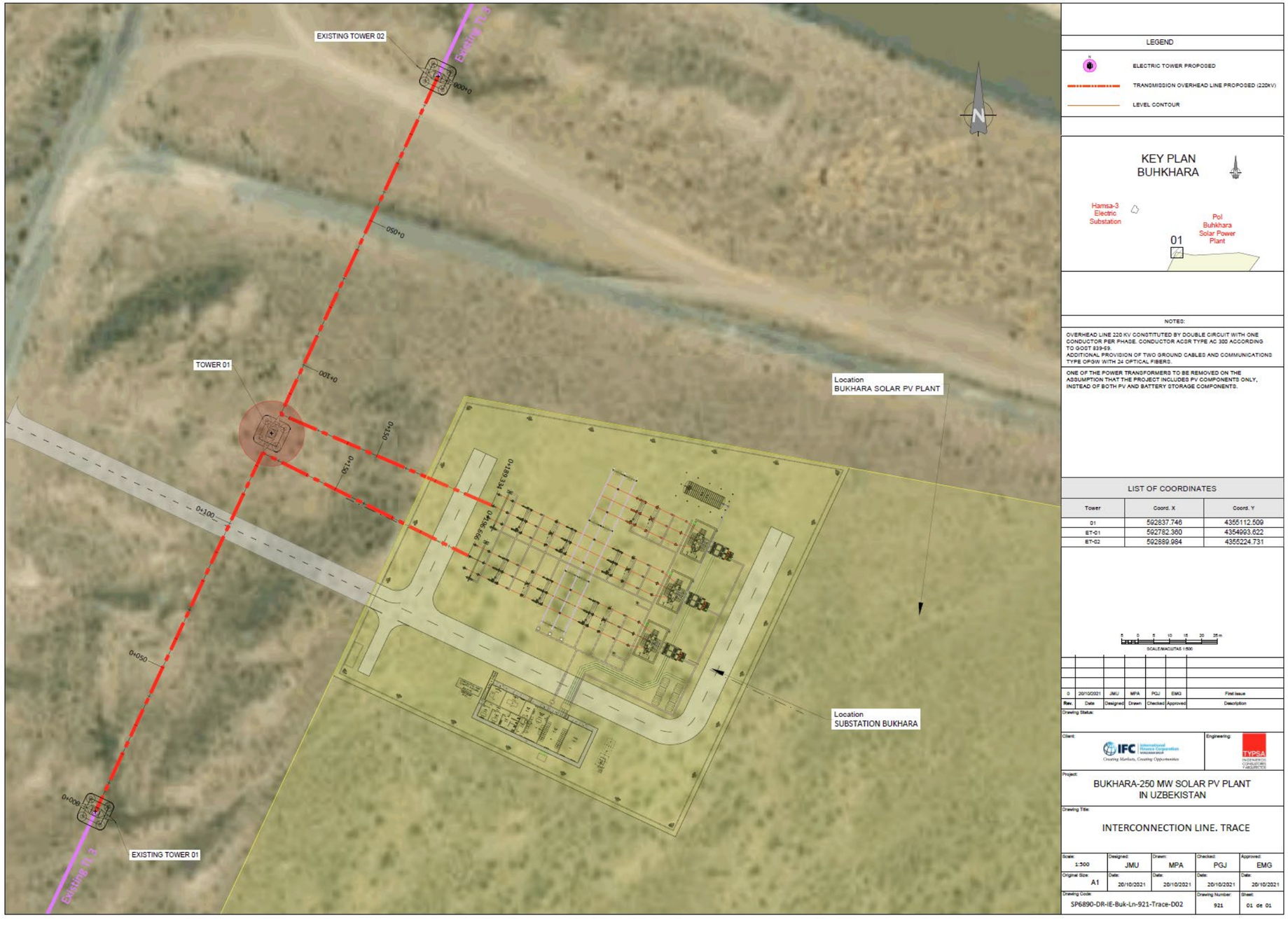
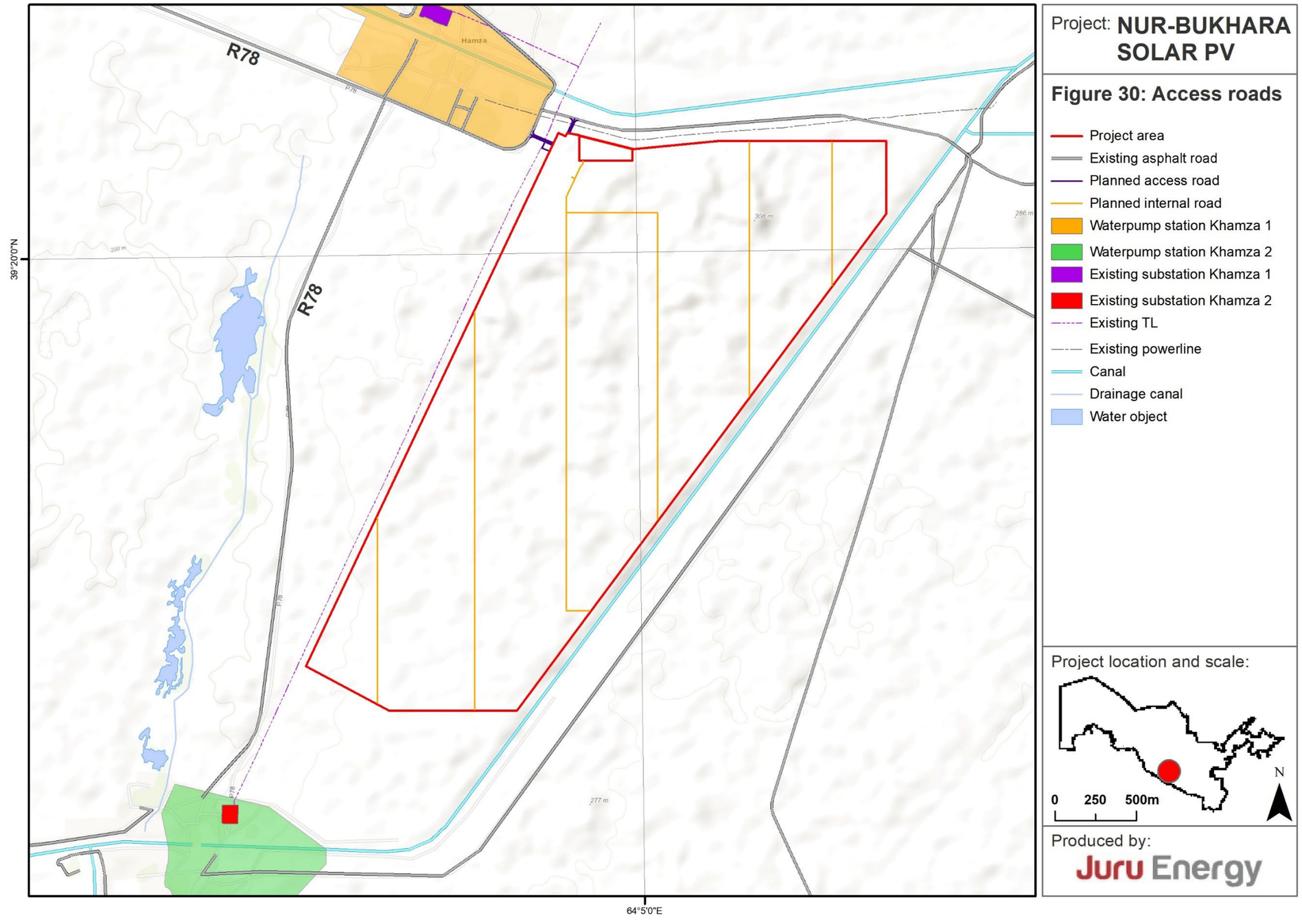


Figure 30: Access Roads (showing access from the existing R78 to the substation/BESS area (green line)



3.7.7 Supporting infrastructure

Supporting infrastructure will include:

- New drainage system (site wide)
- On-site buildings (operational control centre, office, and welfare facilities, first aid facilities) all located within the control room illustrated in Figure 29
- Diesel generator for emergency power supply (located adjacent to the main control room as illustrated in Figure 29)
- Emergency response (fire suppression, hydrants, water storage tanks,) (site wide)

The PV Plant will have a storage drainage system that allows the evacuation of rainwater outside the PV Plant. The drainage system will consist of a perimeter drainage network and another ditch-shaped internal drainage network on the side of the interior roads where runoff water is collected. No groundwater is observed at the Project site; however, the area will be kept dry by designing the buildings to enable runoff away from structures and to ensure drainage for both subsurface and surface water to protect foundations.

Drainage design will be sized for 1:50-year storms and consider future climate change predictions in sizing.

All liquid storage on site (e.g diesel fuel) will be contained within a bunded container with secondary containment measures aligned with IFC EHS Guidelines.

3.8 Construction

3.8.1 Resources

Concrete will be soured from the nearby cement batching plant as described in section 3.4 and located opposite the Khamza -1 pumping station.

The intention is that all aggregates will be sourced on site (during the site grading process) using a cut and fill method, if required to be brought from offsite, a local supplier will be used following the supply chain procedure outlined in the ESMP.

3.8.2 Laydown area

A construction office compound will be established at the start of the construction process within the Project site and will include containers for offices (project company, EPC Contractor and subcontractor), welfare containers, canteen and other needs. The laydown area will be located on an unused area of the Project site adjacent to the substation and BESS area. All materials, equipment, PV panels and containers can be positioned within the planned site boundary.

3.8.3 Water supply and treatment

Construction phase water will be sourced from the municipal water supply source and delivered to the site by tanker for short-term storage and use. Wastewater will also be generated by the Project in the construction compound and facilities (i.e., hand washing, catering and washing tools/equipment). Any areas set aside for washing hands or tools will drain to a containment system for offsite disposal. All water with likely contamination (e.g., from oil or lubricants) will be drained to a suitable containment tank, shipped off site and treated at an appropriate facility. Sewage will

also be generated on site from portable toilets. These will be maintained and emptied regularly to a suitable wastewater treatment facility that is nationally compliant and aligned with GIIP.

3.8.4 Hazardous material storage and management

Any fuel, oil or other hazardous gases, liquids or solids that are stored on site will be contained in an appropriately secure location, with bunding. Any contmained liquid from this area will be taken off site for disposal. A hazardous materials management plan that ensures that materials are stored in accordance with the requirements as set out in the respective material safety data sheets (MSDS).

3.8.5 Security

During construction, a phased approach to security will be employed. At the outset unarmed private security guards will be used to patrol the site perimeter and restrict access onto the site while the permanent fence is erected. Once the permanent fence is erected, private security guards will be employed to provide permanent surveillance and site access control. A guard house will be located at the site entrance for this purpose. If security guards are required to be armed, this will be only with the advance approval of the Project Company and security guards will be subject to additional requirements. All security contractors will be trained on the Voluntary Principles on Security and Human Rights prior to the start of Construction via site induction, toolbox talk briefings during the onboarding process.

3.8.6 Accommodation

Some construction accommodation at the Site is planned to be located in the empty area adjacent to the substation and BESS but within project boundaries as illustrated in Figure 19. The accommodation will be designed and operated following the "Worker's Accommodation Processes and Standards": Guidance Note by IFC and EBRD[1], and will be subject to both internal and external audits (by Lenders' advisor) to asses compliance. In addition, the Project will allow contractors and subcontractors to rent offsite accommodation following a process of selection which will be described in the Labor and Working Conditions Management Plan and provided it meets the requirements of the "Worker's Accommodation Processes and Standards": Guidance Note by IFC and EBRD and adheres to the management and measures stipulated in this ESIA.[10] Accommodation is expected to be in Alat or further afield. Accommodation in the communities of Kulchovdur and Krilishon are not proposed.

3.8.7 Construction workforce

The Project construction phase will last from 12 to 16 months. The works will be led by an engineering, procurement and construction (EPC) contractor who will have a number of contracts with suppliers and sub-contractors for the following activities:

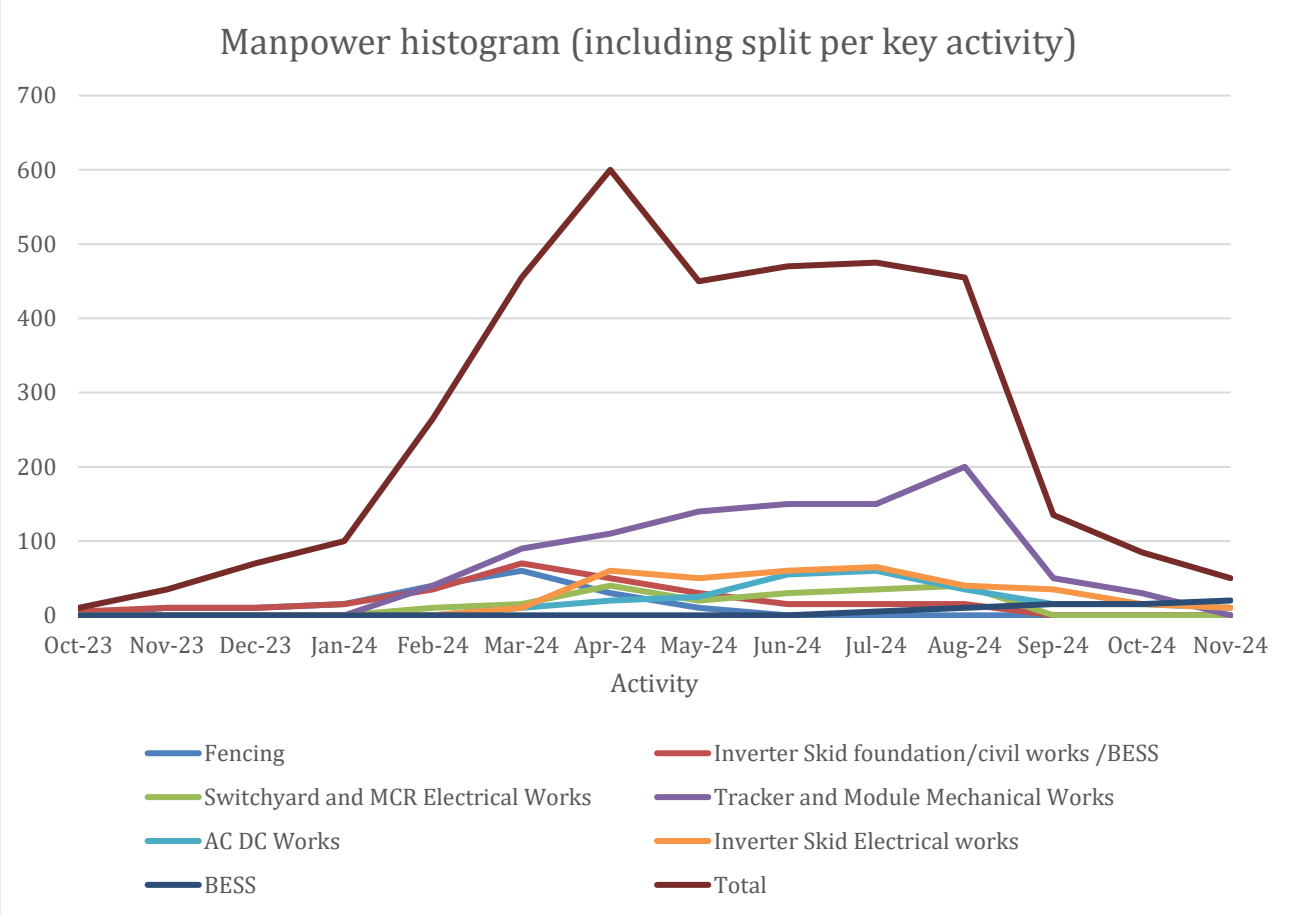
- Transportation contractor
- Civil works /balance of plant contractor
- Electrical contractor (PV site) (low voltage)
- Electrical contractor (medium and high voltage)

[10] The baseline section includes further information about available housing the project area.

- Service suppliers (accommodation, geotechnical surveys, road construction, security, catering)

Figure *31* depicts the approximate number of workers (conservative) for each activity of the construction (civil work, electrical, mechanical installation, and commissioning). The total workforce required during the peak construction period could reach approximately 600 workers (made up of 40% skilled and 60% non-skilled) in April 2024. The EPC Contractor has stated the average workforce throughout the Project will be approximately 200-250 workers, with smaller numbers for mobilization of the Project (approximately 80-100 workers). The EPC Contractor will aim for a breakdown of the workforce of 60% Uzbek workers and 40% expatriate workers.

Figure 31: Manpower plan



3.9 Operation and Maintenance

3.9.1 Water supply and treatment

During operation, water needs at the site will be low. Sanitary water and water for general needs will be supplied by tanker to the project site and stored in an onsite tank sized to the needs of the workforce and operations. Potable water will be bottled. Wastewater generated during the Project operation phase (i.e., greywater, sewage) will be disposed off-site at an approved wastewater treatment facility.

3.9.2 Hazardous material storage and management

It is not expected that any hazardous materials will be stored on site permanently during the operations phase. During maintenance works, contractors will bring to site any necessary hazardous materials (e.g., oils, paints, solvents) and store them in a temporary facility that is secure and bunded and designed to enable proper segregation. The Project will employ GIIP in relation to hazardous material storage and management as defined in WBG EHS Guidelines: General (section 1.5)[11] including:

- Establishing hazardous materials management priorities;
- Avoiding or minimising the use of hazardous materials;
- Measure to prevent the uncontrolled release of hazardous materials to the environment;
- To employ engineering controls where possible; and
- Establish management controls (procedures, inspections, communications, training, and drills) to address residual risks that have not been prevented or controlled through engineering measures (as further defined in this document and ESMP).

3.9.3 Security

The operational security system will have the following features:

- Perimeter security system
- Access control system
- Closed-circuit television (CCTV) system
- Monitors and alarms in the access doors to the MV Power Stations or any other Building of the Installation

The system itself will be responsible for automatically managing the alarm signals, first checking if it is an unwanted alarm. At the point of intrusion, the system will send a warning signal to the security centre and the person responsible will verify the alarm notify as necessary third-party security forces, firefighters, etc.

3.9.4 Accommodation

All accommodation during the operation phase will be offsite in Alat City or Bukhara.

[11] https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-en.pdf

3.9.5 Operations and maintenance workforce

The PV and BESS Plant will be maintained and operated by skilled personnel, ensuring that the system is in optimal condition and that all parts are fully serviced and functional. The permanent workforce is not expected to exceed ten persons and not all persons will be permanently based on site.

During maintenance works the numbers of people on site may increase, but this will be limited to short duration.

3.10 Project activities

3.10.1 Overview

The Project is developed in the following phases:

- Development (including assessment of technology and supplier options, contracting strategy, technical feasibility, E&S assessment, permitting and financing).
- Mobilisation (including detailed design, project implementation activities, local permit requirements, procurement and contracting).
- Construction (including site setup site clearance and excavations, construction and commissioning).
- Operation.
- Decommissioning.

Limited levelling is anticipated at the Site. A cut and fill study will determine the area of levelling required and vegetation clearance will be limited to areas under active construction.

Typical Project activities at each phase are presented below:

- Mobilisation:
  - transportation of civil construction materials to site
  - storing of materials
  - recruitment of local workforce / services
  - identification of local materials.
- Site set up:
  - preparation of accommodation facility
  - procurement
  - construction phase - civil works
  - secure site (fencing)
  - construct internal access road.
- Site clearance / excavations:
  - foundation works (including delivery of cement) (the exact construction piling method is not confirmed at this time, will be confirmed once the geotechnical studies are completed).
  - cabling excavations
  - transportation of large loads materials to site (PV panels, BESS containers and transformers)
  - construction of operations building stores and maintenance yard

- enabling work.

- Construction phase - mechanical and electrical works:
  - PV/BESS infrastructure installation
  - excavation for placement of tracking system
  - construction of substation
  - installation of substation equipment
  - LILO connection.

- Commissioning:
  - PV plant
  - BESS
  - Substation and OHTL.

- Operation:
  - operation of PV / BESS project.
  - day to day maintenance
  - periodic / planned maintenance
  - monitoring.

- Decommissioning (construction):
  - reinstatement of excavated areas
  - removal of construction materials
  - rehabilitation of temporary storage and accommodation areas.

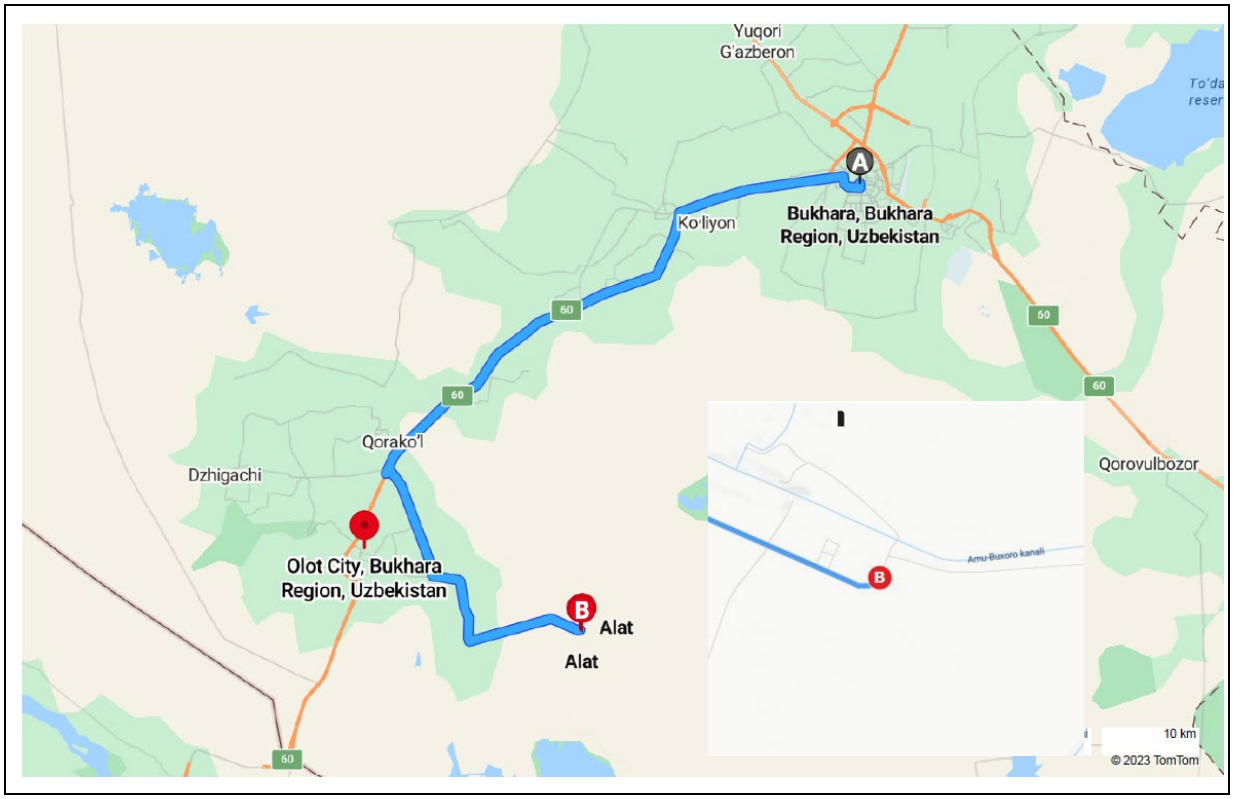
3.10.2 Transportation of components

The transportation of the PV and BESS system from the factory will be a combination of sea and land freight. The main and alternative routing solutions to Uzbekistan are as follows:

- Direct rail route from China via Kazakhstan up to Tashkent hub.
- Sea rail route via Turkey alternative route, by sea to Mersin port in Turkey and further by rail to destination.
- Sea rail route via Baltic Sea alternative route, by deep sea to Baltic ports, and thereafter by rail to destination.

Once in Uzbekistan the national road or rail infrastructure system will be used to transport materials by truck to the Bukhara Region. From Bukhara all equipment will be transported by truck along the main highway (E60/AH5/M37) towards Alat city, before turning east on the R78 towards the site. A separate logistics study will be completed by the transportation contractor on behalf of the EPC contractor to ensure the Project equipment (in particular transformers and BESS containers) can be safety transported along the preferred route. This study will be performed in advance of the transportation of equipment.

Figure 32: Delivery from Bukhara to Project site



Source: 2023 Microsoft corporation (Bing maps)

3.10.3 Operation and Maintenance (O&M)

Routine maintenance will likely be undertaken on the PV and BESS equipment twice a year. This typically consists of a major maintenance period and a minor maintenance period. The major maintenance is relatively non-intrusive and involves checking connections and inspections. This will encompass all PV and BESS equipment, including the fire system. Minor maintenance is typically a visual inspection and rectification of any accumulated noncritical defects.

During operation, all works on the Site will be controlled under safe work systems. This means all work is risk assessed to protect personnel and equipment. The PV Plant and BESS operation will be managed following the operational environmental management plan (OESMP) and under an operational Environmental Social Management System (oESMS).

3.10.4 End-of-life disposal/decommissioning

The expected design life of the Project is 25 years, with individual batteries having a design life of 10 years before they are replaced[12]. The Project components will be continuously maintained throughout the lifetime of the Project. The condition of equipment will be reviewed at the end of the design life to determine whether it remains in a viable condition to continue operation after that time. The facilities may be upgraded or renewed based on the cost-benefit analysis.

If the site is decommissioned, a detailed decommissioning and rehabilitation plan will be developed before these activities take place, taking into consideration available disposal technologies,

[12] Addressed in the waste impact assessment section.

applicable legislation and international good practice that exists at the time of decommissioning. Furthermore, the Masdar supply chain management system sets obligations for buyback and recycling of PV panels and batteries as part of the procurement process.

3.10.5 Project budget

The total capital expenditures (CAPEX) budget for the Project considering the aforementioned Project components is approximately ~ US$275 million.

The total Project operating expenditures (OPEX) are estimated to be approximately ~ US1.3 million per year.

A breakdown of E&S budget for implementation E&S requirements is provide in the ESMP (ESIA Volume IV),

4 Policy, Legislative and Institutional Framework

This section sets out the Uzbek and Lender framework applicable to the Project.

4.1 Relevant government ministries

Key organisations with responsibility for environmental management in Uzbekistan are:

- Cabinet of Ministers of the Republic of Uzbekistan (COM);
- Ministry of Natural Resources (MNR)[13]; and
- The Center for State Ecological Expertise, which is under the MNR.

The Cabinet of Ministers of the Republic of Uzbekistan governs the executive body in the Republic of Uzbekistan following the Constitution of the Republic of Uzbekistan (Article 98) and the Law of the Republic of Uzbekistan "On the Cabinet of Ministers of the Republic of Uzbekistan" (new edition of 2019). The COM exercises the following main functions:

- Implements measures on rational use and protection of natural resources.
- Coordinates the work of state bodies on joint conducting of natural protection events.
- Implements a large-scale ecological program of national and international importance; and
- Takes measures to eliminate the consequences of accidents and disasters as well as natural disasters.

The Ministry of Natural Resources (MNR)[14] is the main regulating body of state administration on environmental protection issues. The primary responsibilities of the MNR include ensuring the implementation of a unified state policy on environmental safety, environmental protection, and the use and reproduction of natural resources; and enforcing state control over the compliance of ministries, state committees, departments, enterprises, institutions, and organisations, as well as individuals, with respect to the use and protection of land, mineral resources, water, forests, flora and fauna, and atmospheric resources. Structurally, the MNR consists of the central unit (located in Tashkent), regional units (oblast) and local (district) units.

[13] Ministry of Natural Resources was organised on a basis of State Committee of Environmental Protection of Uzbekistan by the Presidential Decree of January 25 2023 No. UP-14 "On priority organizational measures for the effective establishment of the activities of the Republican Executive Authorities"

[14] On June 5, 2023 the Ministry of Natural Resources was renamed as Ministry of Ecology, Environmental Protection and Climate Change

The Center for State Ecological Expertise: The Center for State Ecological Expertise's activities are directly related to the evaluation of materials for EIA and the issuance of documents determining compliance with environmental requirements for planned or executed business and other activities, as well as determining the admissibility of the implementation of the object of environmental expertise.

Due to the cross-cutting nature of sustainable development and the environment, virtually all other state bodies have some responsibility towards them. Other stakeholders that are relevant to the Project are listed below:

- Ministry of Energy of the Republic of Uzbekistan.
- Ministry for Emergency Situations of the Republic of Uzbekistan.
- Ministry of Health of the Republic of Uzbekistan.
- Ministry of Poverty Reduction and Employment.
- Ministry of Water Management of the Republic of Uzbekistan.
- Ministry of Agriculture of the Republic of Uzbekistan.
- Cadastre Agency under the Ministry of Economy and Finance of the Republic of Uzbekistan.
- Forestry Agency under the Ministry of Natural Resources of the Republic of Uzbekistan.
- Hydrometeorological Service Agency (Uzhydromet) under the Ministry of Natural Resources of the Republic of Uzbekistan.
- Inspection of Mining, Geology and Industrial Safety Control (Kontekhnazorat) under the Ministry of Mining Industry and Geology of the Republic of Uzbekistan.
- Ministry of Internal Affairs of the Republic of Uzbekistan.

4.2 Constitution of Uzbekistan

The constitution of Uzbekistan has the following provisions relating to environmental aspects:

- Article 49: It is the duty of citizens to protect the historical, spiritual and cultural heritage of the people of Uzbekistan. Cultural monuments shall be protected by the state.
- Article 50: All citizens shall protect the environment.
- Article 53: All forms of ownership of citizens is under protection of state.
- Article 54: No property shall inflict harm to the environment.
- Article 55: Land, subsoils, flora, fauna, and other natural resources are protected by the state and considered as resources of national wealth subject to sustainable use.

4.3 Environmental law

4.3.1 Law on Nature Protection, 1992 as Amended in 2021

This law is the key national environmental law for the protection of the environment and the sustainable use of resources and the right for the population to a clean healthy environment.

This law states legal, economic, and organizational basis for the conservation of the environment and the rational use of natural resources. Article 24 of this law states that the State Environmental Expertise (SEE) is a mandatory measure for environmental protection, preceded to decision making process. In addition, the law prohibits the implementation of any Project without approval from SEE.

It should be noted that Article 53 of this law confirms that if an international treaty concluded by the Republic of Uzbekistan establishes rules other than those provided for by the legislation of the Republic of Uzbekistan on nature protection, the rules of the international treaty shall be applied,

except in cases where the legislation of the Republic of Uzbekistan establishes stricter requirements.

4.3.2 Law on Environmental Control, 2013 as Amended in 2022

The main objectives of this law include:

- Prevention, detection and suppression of violation of legislative requirements relating to environmental protection and rational use of natural resources.
- Monitoring the state of the environment, identifying situations that can lead to environmental pollution, irrational use of natural resources, pose a threat to the life and health of citizens.
- Determination of compliance with environmental requirements of any ongoing economic development activities.
- Ensuring compliance with the rights and legitimate interests of legal entities and individuals performing their duties in relation to environmental protection and sustainable use of natural resources.

The Article 7 of this law states that, the objects of environmental control are:

- Land, its subsoil, waters, flora and fauna, and atmospheric air;
- Natural and man-made sources of impact on the environment; and
- Activities, action or inaction that may lead to pollution of the environment and irrational use of natural resources, create a threat to the life and health of citizens.

4.4 National Environmental Impact Assessment (EIA)

According to the list of activities subject to state ecological expertise, which is established by the Resolution of Cabinet of Ministers No. 541 "On further improvement of the environmental impact assessment mechanism' (2020), power-generating facilities are categorized as follows depending on the level of impact on the environment[15]:

- Thermal, photovoltaic, wind power and other power-generating facilities with a capacity of 300 MW or higher – Category I (high risk);
- Thermal power plants and other power-generating facilities with a capacity of 100 MW to 300 MW – Category II (medium risk);
- Thermal, photovoltaic, wind power, and other power-generating facilities with less than 100 MW capacity – Category III (low risk).

This Project will be categorized as Category II.

The national EIA has been performed by JE in parallel to the ESIA process following the process outlined below. Compliance with national requirements and a positive Environmental Approval are pre-requisites to compliance with Lender requirements. The main regulatory body for national EIA in Uzbekistan is the Ministry of Natural Resources (MNR) of the Republic of Uzbekistan.

Stage I Preliminary EIA report was submitted to the regulator on May 18 and currently is under review.

The MNR performs its activities on the basis of the following legal acts:

[15] Under the Resolution of Cabinet of Ministers of Uzbekistan, No 541, all economic activities are classified into one of four categories of environmental impact: Category I (high risk), Category II (medium risk), Category III (low risk) and Category IV (local impact).

- Presidential Decree of January 25, 2023, No. UP-14 On priority organizational measures for the effective establishment of the activities of the Republican Executive Authorities;
- Presidential Decree of April 21, 2017, No. UP-5024 "On improving the system of public administration in the field of ecology and environmental protection";
- Resolution of the President of the Republic of Uzbekistan of April 21, 2017, No. PP-2915 “On measures to ensure the organization of the activities of the State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection”;
- Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated January 15, 2019, No. 29 “On Approving the Provision on the State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection”;
- Resolution of the President of the Republic of Uzbekistan dated October 3, 2018, No. PP-3956 “On measures to ensure the organization of the activities of the State Committee of the Republic of Uzbekistan on Ecology and Environmental Protection”;
- Decree of the President of the Republic of Uzbekistan, dated 30.12.2021, №-76 "On measures for environmental protection and organization of activities of state bodies in the field of environmental control";
- Resolution of the Cabinet of Ministries of the Republic of Uzbekistan dated October 7, 2020. No.541 “On measures for the further improvement of environmental impact assessment”; and
- other laws and by-laws related to nature protection.

The national EIA procedure is regulated by:

- Law of the Republic of Uzbekistan “On Ecological Expertise” (2000); and
- Regulations "On the State Environmental Expertise", approved by the Resolution of Cabinet of Ministers No. 541 “On further improvement of the environmental impact assessment mechanism’ (2020).

The Resolution specifies the legal requirements for EIA in Uzbekistan. According to the Resolution, the State Environmental Expertise (SEE) is a type of environmental examination carried out by specialized expert divisions to set up the compliance of the planned activities with the environmental requirements and determination of the permissibility of the environmental examination object implementation.

The state unitary enterprise "The Center of the State Environmental Examination" of the MNR, carries out the state environmental examination of EIA of the objects of economic activity classified as categories I and II of environmental impact (high and medium risk).

The state unitary enterprise "The Center of the State Environmental Examination" of the Republic of Karakalpakstan, or the relevant regions performs the state environmental examination of EIA of the objects of economic activity classified as categories III and IV of environmental impact (low risk and local impact).

For this Project the SEE will be performed by the Centre of State Environmental Examination.

National EIAs in Uzbekistan consist of three stages to obtain the Environmental Approval:

- Stage I - Preliminary EIA report – initial and mandatory stage;
- Stage II – Statement on Environmental impacts is a non-mandatory stage and can be skipped if local regulator is satisfied with assessment provided in Preliminary EIA report; and
- Stage III – Statement on Environmental Consequences - is the final stage and output that should be prepared and submitted to the regulator after completing construction/reconstruction works and before the commissioning of the project.

4.4.1 Alignment of ESIA and National EIA report

Stage I Preliminary EIA report - the Preliminary EIA report must contain following information:

- The state of the environment prior to the implementation of the planned activities.
- The population of the territory, land development, analysis of environmental features.
- Situational plan with an indication of the geographical coordinates of the object in question.
- Available recreational areas, settlements, irrigation, land-improvement facilities, farmland.
- Power lines, transport, water, gas pipelines and other information about the area.
- The envisaged (planned) main and auxiliary objects, used equipment, technologies.
- The use of natural resources, materials, raw materials, fuel, analysis of their impact on the environment (both during construction and operation phases).
- Expected emissions, discharges, wastes, their negative impact on the environment and ways to minimize them (both during construction and operation phases).
- Storage and disposal of waste (both during construction and operation phases).
- Analysis of alternatives to the planned or ongoing activities and technological solutions from the standpoint of nature conservation, considering the achievements of science, technology and best practices.
- Organizational, technical, technological solutions and measures that exclude negative environmental consequences and reduce the impact of the object of examination on the environment.
- Analysis of emergency situations (with an assessment of the likelihood and scenario of preventing their negative consequences).
- Forecast of environmental changes and environmental consequences as a result of the implementation of the object of examination.
- Environmental measures to prevent the negative effects of the implementation of the object of examination.
- Results of public hearings.

It is necessary to highlight, that based on changes in local regulation, public hearings must be conducted in accordance with the procedure indicated in the law, represent all environmental impact assessments (to be justified by calculations) for construction and operation phases (if applicable).

Stage II Statement on Environmental impacts – during this phase additional information is provided in relation to key issues e.g., where specific modelling or impact assessment has been required. It is possible the outputs of the finalized EIA process could be communicated at Stage I which may negate the need for additional information to be provided (under Stage II) thus streamlining the approval process and the issue of permits for construction.

The Statement on Environmental impacts should include:

- assessment of environmental problems of the selected site based on the results of engineering and geological surveys, models and other necessary studies;
- environmental analysis of technology in relation to identified problems of the site;
- results of public hearings; and
- reasoned studies of environmental measures to prevent the negative effects of the implementation of the object of examination.

Stage III Statement on Environmental Consequences is the final stage of the SEE process and shall be carried out prior to the commissioning of the project. The report describes in detail the changes in the project made as a result of the analysis of the SEE during the first two stages of the EIA process, the comments received during public hearings, the environmental standards applicable to the project in relation to waste generation, water discharge, air emissions, and the environmental monitoring requirements related to the project, as well as the main conclusions.

4.5 Applicable E&S legislation and standards

4.5.1 Environment

The following Laws are relevant to the Project:

- The Law of the Republic of Uzbekistan “On Water and Water Use” (1993) as amended in 2022;
- The Law of the Republic of Uzbekistan “On Ecological Expertise” (2000) as amended in 2021;
- The Law of the Republic of Uzbekistan “On Atmospheric Air Protection” (1996, amended on 21.04.2021);
- The Law of the Republic of Uzbekistan “On Protection and Use of Vegetation” (1997) as amended in 2016;
- The Law of the Republic of Uzbekistan "On Protection and Use of the Wildlife" (1997) as amended in 2016;
- The Law of the Republic of Uzbekistan “On Protected Natural Reserves” (2004) as amended in 2022;
- The Law of the Republic of Uzbekistan “On Wastes” (2002) as amended in 2021;
- The Law “On the sanitary and epidemiological well-being of the population” (2015) as amended in 2021;
- The Resolution of the Cabinet of Ministries of the Republic of Uzbekistan №541 “On further improvement of the environmental impact assessment mechanism’ (2020) as amended in

2022;

- The Resolution of Cabinet of Ministries of the republic of Uzbekistan №820 "On measures to further improve the economic mechanisms for ensuring nature" (2018) as amended in 2021;
- The Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No 14. "On approval of the regulation on the procedure for the development and agreement of projects with environmental standards" (2014) as amended in 2022; and
- Resolution of Cabinet of Ministers of Republic of Uzbekistan No.95 "On approval of general technical regulations of environmental safety" (2020) as amended in 2022.

4.6 Applicable national environmental standards

4.6.1 Environmental

Uzbekistan has a large set of specific standards that refer to emissions, effluent discharge, and noise standards, as well as standard to handle and dispose specific wastes ranging from sewage to hazardous wastes. The following summarizes these laws and standards along with other international best practice standards. The ESIA will compare all standards (including international/lender standards) and recommend the more stringent standards to be followed.

4.6.2 Air quality

National Standards – Air quality in Uzbekistan is measured against Maximum Permissible Concentrations (MPC) and Maximum Permissible Emissions (MPE). Only Maximum Permissible Concentrations (MPC) are applicable for this project.

Ambient Air Quality Standards, or MPCs, are established by SanPiN 0293-11 (May 16, 2011). According to the United Nations Environment Program (UNEP), Uzbek national ambient air quality standards align with World Health Organization (WHO) standards as adopted by the World Bank Group (WBG) in WBG Environment Health and Safety (EHS) guidelines – General (2007).[16] The MPCs relevant to the Project are shown in Table 8. For this ESIA, the most stringent guidelines will be applied, considering compliance with national and international/lender standards at all times.

[16] https://wedocs.unep.org/bitstream/handle/20.500.11822/17141/Uzbekistan.pdf?sequence=1&isAllowed=y

Table 8: Project Air Quality Limit values

Pollutant	Averaging Period	Objective	Uzbekistan MPC (mg/m^3)	EU AQ Guidelines	WHO Ambient Air Quality Guidelines ($\mu g/m^3$)	Comment
$PM_{2.5}$	Daily				15	
$PM_{2.5}$	Annual	Limit value	-	25 $\mu g/m^3$	5	
PM_{10}	30 minutes	Limit value	0.15		-	
PM_{10}	24 Hour	Limit value	0.1	50 $\mu g/m^3$	45	Not to be exceeded more than 35 days per year
PM_{10}	Monthly	Limit value	0.08		-	
PM_{10}	Annual	Limit value	0.05	40 $\mu g/m^3$	15	
NO_2	30 minutes	Limit value	0.085			
NO_2	Hourly	Limit value	X	200 $\mu g/m^3$	200	Not to be exceeded more than 18 hours per year
NO_2	Daily		0.06		25	
NO_2	Monthly		0.05		-	
NO_2	Annual	Limit value	X	40 $\mu g/m^3$	10	
SO_2	Hourly	Limit value	X	350 $\mu g/m^3$		Not to be exceeded more than 24 hours per year
NO	30 minutes	Limit value	0.6			
NO	Daily	Limit value	0.25		40	
NO	Monthly	Limit value	0.12		-	
NO	Annually	Limit value	0.06		-	
SO_2	30 minutes		0.5			
SO_2	24 hours	Limit value	0.2	125 $\mu g/m^3$	10 (Maximum daily 8 hour mean)	Not to be exceeded more than 3 days per year
SO_2	Monthly	Limit value	01			
SO_2	Annually	Limit value	0.05			
CO	30 minutes	Limit value	5.0			
CO	Maximum daily 8 hour mean	Limit value	4.0	10 mg/m^3		
CO	Monthly	Limit value	3.5			
CO	Annually	Limit value	3.0			

4.6.3 Environmental noise

National noise standards are set out in "*SanPIN No. 0331-16. Admissible noise level into the living area, both inside and outside the buildings*" and is used to ensure the rules of acceptable noise levels for residential areas in Uzbekistan. These rules and regulations establish permissible noise parameters in residential, public buildings and residential buildings of populated areas created by external and internal sources, as well as general requirements for measurements, measurement methods and hygienic noise assessment at research sites. Evaluation of the sound level at the calculation point is performed for the day and night period of the day (from 07:00 to 23:00 hours and from 23:00 to 07:00 hours) and considers the maximum intensity of the sound source level during the half-hour period. Table 9 presents the permissible noise levels for the premises most relevant for the project. To meet WBG guideline requirements noise impacts should not exceed the levels presented in Table 10 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off site.

Table 9: Noise limits from SanPiN No. 0331-16

Purpose of premises or territories	Time	SanPiN No. 0267-09
Territories adjacent to homes, clinics, dispensaries, rest homes, boarding houses, nursing homes, childcare facilities, schools and other educational institutions, libraries.	From 7 am to 11 pm	55 dB(A)
	From 11 pm to 7 am	45 dB(A)

Table 10: WBG Noise Level Guidelines

Receptor	One-hour L_{aeq} (dBA)	
	Daytime 07.00-22.00	**Night-time 22.00 – 07.00**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The levels are almost identical to WBG noise level guidelines which are based on the standards of the World Health organisation (WHO) with the exception of the periods where WBG standards are slightly more stringent, defining night-time noise as applicable at 22:00 instead of 23:00 under national standards.

4.6.4 Workplace noise

SanPiN No. 0325-16. Sanitary Standards for Permissible Noise Levels at the Workplace sets out requirements to protect the health of staff in the workplace in Uzbekistan. This standard provides acceptable noise levels for various types of work, the most relevant of which are listed in Table 11**.** In addition, the WBG provides noise limits for various working environments, which are also illustrated in Table 11**.** These limits will be applied to the Project construction and operation phase.

Table 11: Working environment Noise Limits

Type of work, workplace	SanPiN No. 0325-16	General EHS Guidelines of WBG
Performance of all types of work at permanent workplaces in industrial premises and at enterprises operated since March 12, 1985	80 dB (A)	
Heavy industry		85 Equivalent Level Laeq, 8h
Light industry		50-65 Equivalent Level Laeq, 8h

* Laeq- equivalent average sound pressure level

4.6.5 Water quality and discharges

In Uzbekistan, water resource management, allocation and use fall within the jurisdiction of the Ministry of Agriculture and Water Resources (MAWR), which oversees national authorities, i.e., provincial and district departments of agriculture and water resources, and inter-provincial and inter-district canal management authority. For this Project, the applicable local-level department for management of the ABIS canal is the Amu Bukhara Canal Department (ABCD).

No temporary or permanent discharges (construction, operation) to surface water bodies are envisaged, and no work within or over the adjacent water bodies (ABIS canal or drainage canals and ponds) is proposed. However, the following regulations are relevant if this approach changes.

- Sanitary requirements for development and approval of maximum allowed discharges (MAD) of pollutants discharged into the water bodies with waste waters (SanPin No. 0202-06).
- SanPiN No 0255-08, which provides the maximum permissible concentrations for hygienic assessment of the level of water bodies.

In Uzbekistan, all water bodies are categorised into four categories and applied to the respective water quality standard. For this Project, the fishery water use standard for water quality is applicable.

Table 12: Criteria for pollutants in the water of surface water bodies by category of use[17]

Name of parameters	Fishery water use	Cultural and domestic water use.	Domestic Drinking water	Irrigation water use
COD, mgO_2/dm^3	**15**	40	30	40
BOD, mgO_2/dm^3	**3**	3-6	3-7	10
pH	**6.5-8.5**	6.5-8.5	6.5-8.5	6.5-8.5
Total suspended solids mg/dm^3	**15**	30	30	50
Mineralization mg/dm^3	**1000**	1000	1000–1500	1000
Sulphates mg/dm^3	**100**	500	400-500	
Chloride mg/dm^3	**300**	350	250-350	

[17] Source: "Handbook of the Ecologist-Expert". State Committee of the Republic of Uzbekistan on Nature Protection. State Environmental Expertise 2009. Tashkent.

Name of parameters	Fishery water use	Cultural and domestic water use.	Domestic Drinking water	Irrigation water use
Ammonium nitrogen (NH4+N)	**0,5**	2	0.5	1.5
Nitrite nitrogen (NO2-N)	**0.02**	0.5	3	0.5
Nitrate nitrogen (NO3-N)	**9.1**	25	45	25
Nitrites	**0.08**	3.3	3	
Nitrates	**40**	45	45	
Phosphates (PO_4^{3-})	**0.3**	1	3.5	1
Ether - soluble	**0.05**	0.8	0.8	0.8
Petroleum products	**0.05**	0.3	0.1	0.3
Surfactants	**0.1**	0.5	0.5	0.5
Phenol	**0.001**	0.001	0.001-0.1	0.001
Fluorine (F)	**0.05**	1.5	0.7	1
Arsenic (As)	**0.05**	0.05	0.05	0.1
Iron (Fe)	**0.05**	0.5	0.3-3	5
Chrome (Cr6-)	**0.001**	0.1	0.05	0.1
Copper (Cu)	**0.001**	1	1	1
Zinc (Zn)	**0.01**	1	3	5
Cyanides	**0.05**	0.1		
Lead (Pb)	**0.03**	0.1	0.03	0.2
Nickel (Ni)	**0.01**	0.1	0.1	
Cadmium (Cd)	**0.005**	0.01		
Cobalt (Co)	**0.1**	1		
Molybdenum (Mo)	**0.0012**	0.5	0.25	
Strontium (Sr2+)		2	7	
Selenium (Se)	**0.001**		0.01	
Rodanids	**0.1**			
Mercury (Hg)		0.005	0.0005	

4.6.6 Water protection zone

The COM Decree № 981 of December 11, 2019 *"Regulation on the procedure of establishing water protection zones and sanitary protection zones (SPZ) for water bodies on the territory of the Republic of Uzbekistan*" sets a water protection zone (WPZ) around water channels as follows:

- for channels with a capacity from 50 to 100 cubic meters of water per second — 50 to 70 meters;
- for channels with a capacity from 100 to 150 cubic meters of water per second — 70 — 100 meters; and
- for channels with a capacity of more than 150 cubic meters of water per second — 100 — 150 meters.

The ABIS canal borders the project site to the north, east and south of the site and is managed by ABCD. The ABIS canal in this area can be classified as having more ta 150 m^3 of water per second flowing in the channel. Correspondence with ABCD confirmed that water protection zones are set at 100 m for canals with a water conveyance capacity of up to 100 m^3/s, and at 150 m for canals with

a water conveyance capacity of above 100 m^3/s[18]. The proposed Project fence line (as provided by the Ministry of Energy during the auction process) comes to within 70 m at the nearest point and therefore, a request to reduce the WPZ to 70 m was submitted to ABCD[19] and approved[20]. The approved water protection zone (WPZ) for the Project is 70 m from the edge of the ABIS canal.

The approval was based on the following considerations as determined through the ESIA process, and with specific consideration of the potential risks to the ABIS canal:

- Baseline surveys conducted as part of the environmental and social assessment works, the ecological sensitivity of the canal and the riparian vegetation is medium to low (refer to section 8.5 and section 8.8).
- The Project will use dry cleaning techniques to clean the panels, thereby eliminating potentially contaminated runoff. The operation of this Project does not result in any pollutant discharges during normal or emergency operation.
- The location of the main activity at the substation site and the battery storage site is to the northwest of the site and more than 150 from the site boundary. Furthermore, encroachment of the panels to within the 150m of the canal is not consistent along the whole site boundary.
- The construction of a solar PV project requires minimal excavation work and the use of chemicals or other pollutants. Best practice principles will be employed to ensure that any refuelling areas or storage areas are to the north of the site, more than 150m from the boundary of the canal.
- For further protection of the canal, it is proposed to fence the site boundary as part of the pre-construction work, and therefore workers or equipment/machinery will not be allowed to encroach on the 70m buffer zone.
- A detailed Environmental and Social Management System (ESMS) will be implemented by the engineering, procurement, and construction (EPC) Contractor to meet international standards for environmental management to ensure that the construction activities do not impact the canal. The ESMS will include detailed mitigation measures, such as dust and sediment control measures, to prevent any impacts or sedimentation in the canal.

The Project also proposes to monitor the canal baseline water quality (already collected as part of the ESIA process) at a suitable frequency during the construction and operation works to demonstrate the effectiveness of the mitigation measures and no impact on the canal water quality.

[18] Response to JEC-OUT-23-144 dated April 19, 2023 (April 27 2023, No. 63), ESIA TA 11 (Letters).
[19] № JEC-OUT-23-164 (dated 4th May 2023) (request to reduce WPZ)
[20] Letter response from ABCD ESIA TA 11 (Letters).

4.6.7 Waste management

Waste management laws relevant to the Project are listed below and key requirements described in the following sections:

- Law of the Republic of Uzbekistan "On wastes" (2002) amended in 2029"; and
- SanPin № 0127-02 "Sanitary Procedures for inventory, classification, storage and disposal of industrial waste"

Law of the Republic of Uzbekistan "On wastes" (2002) amended in 2029

The principal objective of this law is to prevent the negative impacts of solid wastes on human lives and health as well as the environment, reduce waste generation and encourage rational use of waste reduction techniques. Key provisions relevant to the Project are:

- Article 19 Provided generated waste is subject to export and import operations, or hazardous waste is subject to transportation, an environmental certification procedure shall be completed by the Project to confirm compliance with sanitary and environmental norms and standards associated with waste management.
- Article 20 states that transportation of hazardous waste shall be in specially designated types of vehicles with a waste certificate and permit. The responsibility for safe transportation of hazardous waste shall be with the transporting organisation.
- Article 22 of the Law on Wastes specifies the general requirements for waste storage and disposal. Waste disposal of recyclable waste is prohibited in Uzbekistan. In addition, storage and disposal of waste in the environment including in nature conservation and protected areas, settlements, health and recreational areas or historical and cultural facilities is prohibited.

SanPiN of the Republic of Uzbekistan dated 29/7/2002 No 0128-02 – "Hygienic classifier of toxic industrial wastes in the Republic of Uzbekistan

This regulation and norm ensure optimal hygienic accounting and inventory of industrial wastes, determination of toxicity index and classification of industrial waste by hazard classes with optimal selection of ways to neutralise and utilise them.

SanPiN No 0127-02-Sanitary procedures for industrial waste inventory, classification, storage and disposal

Hazardous waste is classified into four groups known as "hazard classes" as follows:

- Class I: Extremely hazardous waste
- Class II: Highly hazardous waste
- Class III: Moderately hazardous waste
- Class IV: Low hazardous waste

Other relevant regulations and standards are listed below, and their requirements will be incorporated into the ESIA assessment:

- SanPiN № 0157-04 “Sanitary requirements to the storage and neutralization of solid domestic waste on special grounds in Uzbekistan”.
- SanPiN of the Republic of Uzbekistan dated 16/11/2011 No 0300-11 “Sanitary Rules and Standards for managing collection, inventory, classification, treatment, storage and disposal of industrial waste in the context of Uzbekistan.
- Regulation “On the Procedure for the Disposal, Collection, Pay Settlement, Storage and Removal of Waste Industrial Oils” annexed to the Decree of the Cabinet of Ministers dated 04/09/2012 No.258.
- Regulation on the Procedure for Handling Coloured and Black Metal Scrap" annexed to the Decree of Cabinet of Ministers dated 06/06/2018 No. 425.
- SanPiN No. 0158-04 - Sanitarian Rules and Norms on collection, transportation and disposal of wastes containing asbestos in Uzbekistan.

4.6.8 Land rights, acquisition and resettlement

The following land Laws are relevant to the Project:

- Civil Code of the Republic of Uzbekistan (1997) as amended on 8.11.2022.
- Land Code of the Republic of Uzbekistan (1998) as amended on 1.10.2022.
- Law of the Republic of Uzbekistan on State Land Cadastre No.666-I of 28.08.1998.
- Presidential Decree № UP-5495. Decree “On measures on cardinal improvement of investment climate in the republic of Uzbekistan".
- Appendix No. 2 to the Resolution of the Cabinet of Ministers № 146 (2011), regulation “On the Procedure for Compensation for Losses of Landowners, Users, Tenants and Owners, as well as Losses of Agricultural and Forestry Production”.
- Resolution № 911 of the Cabinet of Ministers (2019) “On the Procedure for withdrawing land plots and compensation to owners of immovable property located on the land plot.
- Law No 781 “On procedures for the withdrawal of land plots for public needs with compensation” October 1st, 2022.[21]

Law No. 781 specifies cases when the land plots can be acquired for public need, among which construction (reconstruction) of roads and railways of national and local significance is also specified. Law No. 781 also prescribes land acquisition procedures, procedures for communication with project-affected people (PAPs), compensation calculations, and demolition of affected assets. From October 1st, 2022, all projects requiring land acquisition for public needs should be managed following this Law.

4.6.9 Right of way and land acquisition process in Uzbekistan

Procedures to establish a right of way (ROW) in Uzbekistan are the same for legal entities and individuals. ROW or limited use of a land plot is determined in the Land Code of Uzbekistan, Civil Code (under the term servitude), and the Resolution of Cabinet of Ministries No. 911 dated

[21] Law 911 and Law 781 work alongside each other to address land withdrawal and compensation matters.

November 16th, 2019. All grid interconnection works are expected to be undertaken within the existing ROW; however, for completeness, the requirements for establishing a ROW are presented below, and their applicability will be confirmed during the ESIA process.

Article 30 of the Land Code (LC) determines engineering, electrical power and other lines and constructions as a reason for receiving the right to servitude. Following Article 30 of the Land Code, Article 173 of the Civil Code (CC), and Article 30 of Annex 1 of the Resolution of Cabinet of Ministers No. 1060 dated December 29, 2018, servitude is established by agreement between persons demanding the establishment of servitude and the owner, user, lessee, proprietor of the land plot. If they do not achieve consent, the servitude shall be established by a court decision at the user's claim. The agreement on servitude shall be subject to state registration and preserved when the land plot is transferred to another person. Servitude agreements can be terminated in cases of the cessation of the reason according to which it was established.

Article 173 of CC also states that the burdening of a land parcel by servitude does not deprive the owner of the parcel of the rights of possession, use, and disposition of this parcel.

Calculation and compensation of losses due to servitude agreement are performed following Law No 781 “On procedures for the withdrawal of land plots for public needs with compensation” (if it is a project for public needs) the Resolutions of Cabinet of Ministers No.146 from 25 May 2011 “On measures to improve the procedure for granting land plots for urban development activities and other non-agricultural purposes” and No. 911 from 16 November 2019 “On additional measures for enhancing modalities of providing compensation on withdrawal and allocation of land plots and safeguard the property rights legal and physical entities”.

Article 86 of the LC states that losses caused to the owners of land parcels, landowners, land users and lessees are liable to be fully refunded (including the lost profit) in the case of limitation of their rights in connection with land acquisition. Refunding of losses is carried out at the expense of the resources of the corresponding centralized funds for compensation of losses to individuals and legal entities in connection with the seizure of land plots from them for public needs and by enterprises, establishments and organizations the activity of which causes limitation of rights of land parcel owners, landowners, land users and lessees or worsening the quality of the neighbouring lands in the order established by legislation.

Article 173 of the CC states that the parcel owner burdened with the servitude has the right unless otherwise provided by a Law, to demand from the person in whose interests the servitude is established proportional payment for the use of the parcel.

4.6.10 National norms and standards for transmission lines and PV projects

An essential standard for establishing OHTL is SanPiN No.0350-17 “For the Protection of Atmospheric Air in Populated Areas of the Republic of Uzbekistan” (2017). This standard defines health protection zones (HPZ), also known as setbacks for OHTL. According to SanPiN No.0350-17, section 2.23.4, an HPZ must be established to protect the population from the effects of an OHTL's electric field. HPZ’s are defined as the land along the route of a high-voltage OHTL in which the

electric field strength exceeds 1 kV/m. For newly designed OHTL, buildings and structures must be set back the following distances either side of the OHTL[22]:

- 20 m for OHTL with a voltage of 330 kV;
- 30 m for OHTL with a voltage of 500 kV;
- 40 m for OHTL with a voltage of 750 kV;
- 55 m for OHTL with a voltage of 1150 kV.

Other relevant national laws and regulations to OHTL projects include:

- Resolution of Cabinet of Ministers of Republic of Uzbekistan No.95 "On approval of general technical regulations of environmental safety" (2020).
- Decree of the Cabinet of Ministers of the Republic of Uzbekistan No.1050 "On approval of Rules for Protection of Power Grid Facilities, 2018".
- SanPiN & Norms No. 0236-07 "Sanitary norms and rules to ensure safety for people living near high voltage power transmission lines, 2007".

For this project, a 30 m set back is applicable to any new line or refurbished existing line.

The HPZ for PV power plants are not provided by local laws. An HPZ of 250 meters has been established specifically for this Project on the basis of technical data sheets (passports) provided by the manufacturers of PV plant equipment and the results of appropriate calculations of the electrical magnetic field distribution on the environment. This has been approved by the competent authority.

4.6.11 Labour and employment

The labour policy in Uzbekistan is applied at the national government level and is reflected in the following relevant laws, regulations, and national social programmes.

- Labour Code of the Republic of Uzbekistan 1996 as amended on 18.05.2022.
- Law "On the employment of the population" No. 642 of 20.10.2020.
- Resolution of the Ministry of Labour and Social Protection of the Population, Ministry of Health of the Republic of Uzbekistan, registered on 29.07.2009, reg. number 1990 "About the approval of the list of occupations with unfavourable conditions, in which the use of the labour of persons under 18 years of age is prohibited".
- Decree No. 133 of 11 March 1997 to approve normative acts necessary for the realization of the Labour Code of the Republic of Uzbekistan.
- Decree of the Cabinet of the Ministers No. 1011 of 22 December 2017 "On Perfection of the Methodology of Definition of Number of People in Need of Job Placement, including the Methodology for Observing Households with Regard to Employment Issues, also for the Development of Balance of Labour Resources, Employment and Job Placement of Population".
- Decree of the Cabinet of the Ministers No. 965 of 5 December 2017 "On the Measures of Further Perfection of the Procedure of Establishment and Reservation of Minimum Number

[22] The HPZ (set back) is defined as the distance from the outermost wires in a direction perpendicular to the OHTL.

of Job Places for the Job Placement of Persons who are in Need of Social Protection and Face Difficulties in Searching Employment and Incapable of Competing in Labour Market with Equal Conditions".

- Decree No. 964 of 5 December 2017, "On the Measures for Perfection of the Activity of Self-Government Bodies Aimed at Ensuring Employment, Firstly for the Youth and Women".

As a member of the International Labour Organization (ILO) since 1992, Uzbekistan has ratified 17 ILO conventions, including the eight fundamental conventions (shown in bold in Table 13 below).

Table 13: Labor Conventions Ratified by Uzbekistan

Convention (fundamental conventions in bold)	Date
Universal Declaration of Human Rights (1948)	1991
CCPR - International Covenant on Civil and Political Rights (1966)	28-Sep-95
Convention on the Elimination of All Forms of Intolerance and Discrimination Based on Religion or Belief (1981)	30-Aug-97
EU Partnership and Cooperation Agreement (1996)	21-Jun -96
C029 - Forced Labour Convention, 1930 (No. 29)	13-Jul-92
P029 - Protocol of 2014 to the Forced Labour Convention, 1930	16-Sep-19
C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)	12-Dec-16
C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98)	13-Jul-92
C100 - Equal Remuneration Convention, 1951 (No. 100)	13-Jul-92
C105 - Abolition of Forced Labour Convention, 1957 (No. 105)	15-Dec-97
C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)	13-Jul-92
C138 - Minimum Age Convention, 1973 (No. 138) Minimum age specified: 15 years	06-Mar-09
C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)	24-Jun-08
C081 - Labour Inspection Convention, 1947 (No. 81)	19-Nov-19
C122 - Employment Policy Convention, 1964 (No. 122)	13-Jul-92
C129 - Labour Inspection (Agriculture) Convention, 1969 (No. 129)	19-Nov-19
C144 - Tripartite Consultation (International Labour Standards) Convention, 1976 (No. 144)	13-Aug-19
C047 - Forty-Hour Week Convention, 1935 (No. 47)	13-Jul-92

Convention (fundamental conventions in bold)	Date
C052 - Holidays with Pay Convention, 1936 (No. 52)	13-Jul-92
C103 - Maternity Protection Convention (Revised), 1952 (No. 103)	13-Jul-92
C135 - Workers' Representatives Convention, 1971 (No. 135)	15-Dec-97
C154 - Collective Bargaining Convention, 1981 (No. 154)	15-Dec-97
CEDAW - Convention on the Elimination of All Forms of Discrimination against Women	19-Jul-95
C187 - Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187)	14-Sep-21

Measures have been enacted via a national action plan to implement these conventions into national law, including a legal and institutional framework to prevent forced labour. The legislation of the Republic of Uzbekistan (Constitution, Labour Code, Law on Employment) prohibited the use of child and forced labour. Article 7 of the Labour Code stipulates that forced labour, namely compulsion to perform work under the threat of some form of punishment (including as a means of labour discipline) is prohibited.

4.6.12 Permits and licenses

Required permits and licenses are provided in a preliminary permit register in Volume III: ESIA Technical Appendix. A permit register will be maintained for the Project duration and reviewed and updated regularly.

4.7 Lender requirements

The following Lender requirements will be considered to provide maximum flexibility to the Project financing.

4.7.1 International Finance Corporation (IFC)

The Project will principally set out to comply with the requirements of the IFC Performance Standards 2012 (IFC PSs), including:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.
- Performance Standard 2: Labour and Working Conditions
- Performance Standard 3: Resource Efficiency and Pollution Prevention.
- Performance Standard 4: Community Health, Safety, and Security.
- Performance Standard 5: Land Acquisition and Involuntary Resettlement.
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

The following PSs are not triggered for this Project (as described in subsequent sections).

- Performance Standard 7: Indigenous Peoples.
- Performance Standard 8: Cultural Heritage.

IFC PS1 establishes the importance of: (i) integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) management of social and environmental performance throughout the life of the project.

IFC PS2 through IFC PS8 establish requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, IFC PS2 through IFC PS8 describe potential social and environmental impacts that require particular attention in emerging economies and sensitive and critical natural and human environments. Where social or environmental impacts are anticipated, they are to be managed through an Environmental and Social Management System (ESMS) consistent with the requirements of IFC PS1.

IFC PS3 refers to the World Bank Group (WBG) Environment, Health and Safety (EHS) Guidelines. These guidelines are the technical reference documents for environmental protection and set out specific examples of good international industry practice (GIIP). The General EHS Guidelines contain information on crosscutting issues applicable to projects in all industry sectors, including geothermal. They guide performance levels and measurements considered achievable at a reasonable cost by new or existing projects using existing technologies and practices. This Project is expected to comply with standards and guidelines identified in the General EHS Guidelines alongside host country requirements.

The Project is expected to be assigned a Category B under potential IFC Environmental and Social Policy i.e., *"Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures".*

4.7.2 World Bank Group Guidelines

The WBG EHS Guidelines applicable to the Project are listed as follows:

- WBG General EHS Guidelines (April 2007) - cover the four areas of the environment; occupational health & safety (OHS); community health & safety (CHS); construction and decommissioning; and
- WBG EHS Guidelines Electric Power Transmission and Distribution (April 2007).

4.7.3 Asian Development Bank (ADB) Safeguard Policy Statement (SPS) (SPS 2009)

ADB SPS 2009 sets out three key safeguard policies as follows:

- Safeguard Requirements 1: Environment;
- Safeguard Requirements 2: Involuntary Resettlement); and

- Safeguard Requirements 3: Indigenous Peoples (not expected to be triggered for this Project).

The requirements of these safeguards are aligned with the requirements of IFC PSs (as outlined above) relating to identification of impacts, the requirement to develop and implement plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts; and to ensure affected people are informed and consulted during project preparation and implementation. They are also aligned on the topics of climate change, gender and biodiversity and require projects to reflect internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines (refer to section 4.7.2 above). Other key ADB policy documentation relevant to this Project includes:

- ADB Social Protection Strategy (2001);
- ADB Access to Information Policy (2018) ; and
- ADB Gender and Development Policy (1998).

4.7.4 EBRD Policy

The ESIA will also consider the E&S requirements of the EBRD as set out in the following Performance Requirements (PRs), where there are material requirements over and above the IFC PSs. The ESIA will also consider best available practice (BAT) and key EU Directives where applicable.

- The European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy 2019 (ESP 2019); and
- EBRD PRs:
    - PR1 – Assessment and Management of Environmental and Social Risks and Impacts;
    - PR2 – Labour and Working Conditions;
    - PR3 – Resource Efficiency and Pollution Prevention and Control;
    - PR4 – Health, Safety and Security;
    - PR5 – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
    - PR6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources; and
    - PR10 – Information Disclosure and Stakeholder Engagement.

The following PRs are not triggered for this Project (as described in subsequent sections).

- PR7 – Indigenous Peoples; and
- PR8 – Cultural Heritage.

With reference to EBRD ESP 2019, Appendix 2, this project is expected to be assigned as Category "B". A project is categorised B when "*its potential environmental and/or social impacts are typically site-specific and/or readily identified and addressed through effective mitigation measures*". EBRD will determine the scope of environmental and social appraisal on a case-by-case basis. Category B projects do not require EBRD disclosure of key ESIA documents over and above the requirements of PR10.

4.7.5 Equator Principles

The Equator Principles (EPs) are voluntary standards signed up by various financing institutions to serve as a common baseline and risk assessment framework. EP4 includes ten principles covering:

- Review and categorisation
- E&S Assessment
- Applicable E&S Standards
- E&S Management and EP Action Plan
- Stakeholder Engagement
- Grievance Mechanism
- Independent Review
- Covenants
- Independent Monitoring and Reporting
- Reporting and Transparency

This project is expected to be assigned as a "Category B" requiring it to apply the requirements of the applicable IFC PSs and WBG EHS Guidelines as defined above. The project must also implement effective stakeholder engagement, grievance management and an Environmental and Social Management System (ESMS). EP4 also sets out specific requirements relating to Human Rights (HR) in line with the United Nations Guiding Principles on Business and Human Rights (UNGPs) by requiring human rights due diligence (HRDD[23]) and climate change risk assessment (CCRA)[24] following recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).

4.7.6 Good International Industry Practice (GIIP)

The Project will apply the following GIIP during the development, construction, and operation phase.

- World Bank, Utility-Scale Solar Photovoltaic Power Plants. A Project Developer's Guide (2015)
- Solar Construction Safety Manual - https://www.coshnetwork.org/sites/default/files/OSEIA_Solar_Safety_12-06.pdf
- EBRD Eligibility Criteria for Solar Projects. Available at https://www.ebrd.com/who-we-are/our-values/environmental-emanual-risk.html
- PRI Managing ESG Risk in the Supply Chains of Private Companies. Available at: www.unpri.org/download?ac=1894 Voluntary Principles on Security and Human Rights (est. 2000); (http://www.voluntaryprinciples.org/).
- United Nations Guiding Principles for "Protect, Respect and Remedy" Human Rights Framework (2011); (https://www.business-humanrights.org/en/un-secretary-generals-special-representative-on-business-human-rights/un-protect-respect-and-remedy-framework-and-guiding-principles).

[23] Nur Bukhara solar PV and BESS project Human Rights Impact Assessment (HRIA), May 2023 is provided in Technical Appendix III.

[24] Nur Bukhara solar PV and BESS project climate change risk assessment (CCRA), May 2023 is provided in Technical Appendix III.

- United Nations Code of Conduct for Law Enforcement Officials; and (https://www.un.org/ruleoflaw/blog/document/code-of-conduct-for-law-enforcement-officials/).
- United Nations Basic Principles on the Use of Force and Firearms by Law.
- Use of Security Forces: Assessing and Managing Risks and Impacts (February 2017).
- Worker's Accommodation: Processes and Standards (Guidance Note by IFC and EBRD, 2009).
- Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets, 2007.
- World Bank (2016a). Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labor Influx. The World Bank, Washington, D.C.

4.7.7 International conventions and agreements

Fundamental conventions and agreements (in addition to the ILO conventions mentioned in Table 13 signed and ratified by Uzbekistan that are relevant to the Project are provided in Table 14.

4.7.8 Climate policy

Multi-lateral development banks have developed their own climate related policies for alignment with the Paris Agreement. These can be summarised as follows[25]:

IFC:

- Committed to 85% alignment starting 01 July 2023
- 100% alignment starting 01 July 2025
- Growing its climate- related investments to an annual average of 35 percent of its own-account long- term commitment volume between 2021 and 2025

EBRD:

- From end-2022, all activities to be Paris aligned.
- Increasing green financing to >50% by 2025.
- Aims to achieve cumulative net GHG emissions reductions of 25- 40 million tons annually.

Table 14: Conventions relevant to the Project that Uzbekistan has ratified

Convention name
ENVIRONMENT / CLIMATE CHANGE
United Nations Framework Convention on Climate Change (UNFCC) (New York, 1992) (Official Gazette of RM no. 61/97) including Paris Agreement (joined April 2017)
United Nations Convention on Biological Diversity (Official Gazette of RM no. 54/97)
United Nations Convention to Combat Desertification (UNCCD) (26/12/2006)

[25] IFC Technical Guidance for Financial Institutions — Assessment of Greenhouse gas emissions (2023)

Convention name
Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (05/26/1993)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (12/22/1995)
The Convention on the Protection and Use of Transboundary Watercourses and International Lakes
Convention Concerning the Protection of the World's Cultural and Natural Heritage (ratified 1993)
Convention for the Safeguarding of the Intangible Cultural Heritage. Paris (ratified 2008)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (07/01/1997)
Convention on the Conservation of the Migratory Species of Wild Animals (Bonn Convention) (05/01/1998)
Convention on Wetlands of International Importance, especially the Waterfowl Habitats of Aquatic Birds (Ramsar Convention) (1975) (ratified 2001)
Vienna Convention for the Protection of the Ozone Layer (1985).
Montreal Protocol to Protect the Ozone Layer (including 1990 and 1999 amendments)
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) - the 'Espoo (EIA) Convention'
Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (Aarhus Convention) (Official Gazette of RM no. 40/99

5 Baseline Conditions

5.1 Area of influence

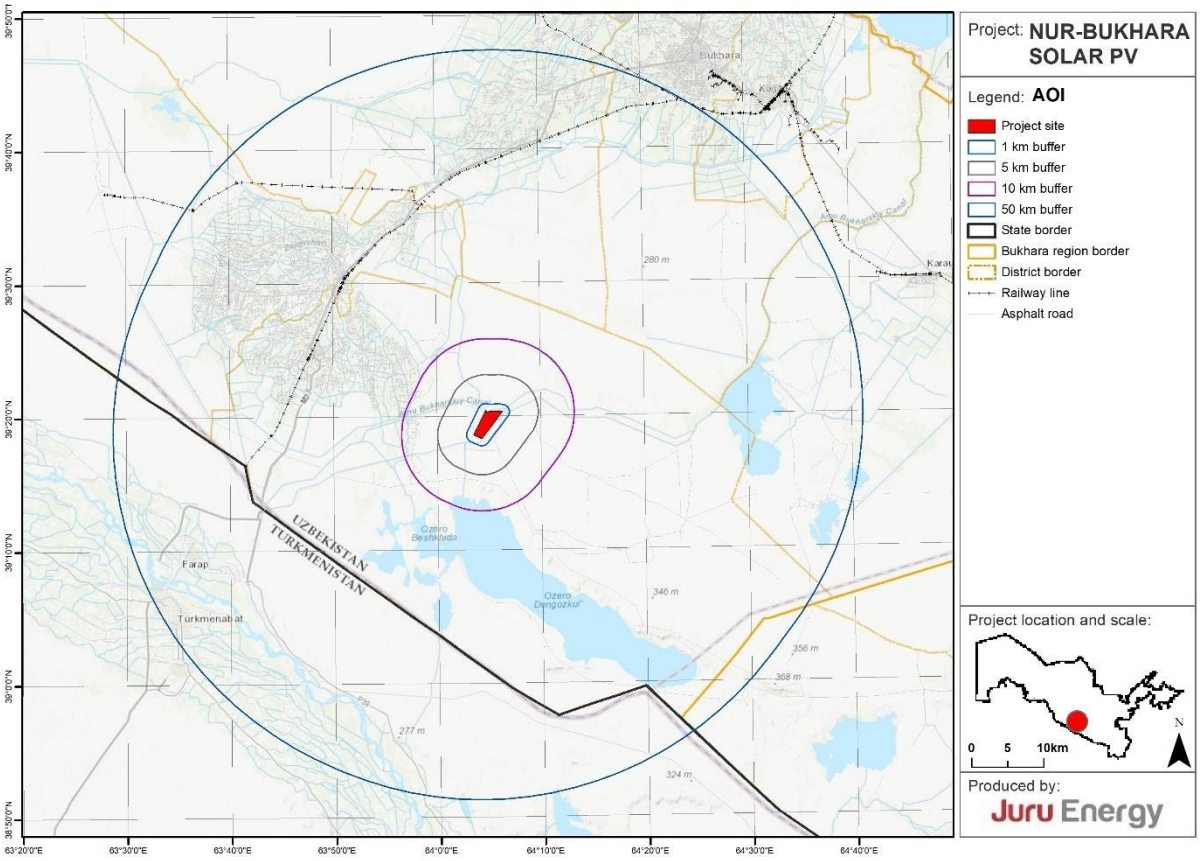
The area of influence (AOI) is defined by where Project impacts may be felt or observed, e.g., the zone of visual impact or the distance from the working area where noise or air quality impacts may be identified. The indirect AOI area is defined as where secondary or induced benefits or impacts may be realized, including employment impacts or impacts from an influx of workers.

The Project direct AOI often varies depending on the specific environmental or social aspect considered based on the extent an impact may be affected and can be influenced on a spatial and temporal level.

For the scoping phase an initial AOI of approximately 50 km from the Project site has been defined considering the potential avifauna risks and potential impacts and benefits on the wider communities in the AOI (see Figure 33).

The topic-specific AOI are described in the individual impact assessment sections below and have been informed by GIIP, outcomes of the scoping process and stakeholder engagement during the ESIA data collection process.

Figure 33: General AOI



5.2 Baseline data collection – summary of activities

Baseline data collection to inform the ESIA has been obtained from secondary source information, including:

- Desk-based reviews of laws, policies, reports from the relevant governmental and non-governmental institutions and existing national and international publicly available information data from websites.
- Review of the IFC Environmental and Social Scoping Report – Bukhara Solar PV Project prepared by TYPSA and dated 07 February 2022.
- Review of the IFC Critical Habitat Assessment – Bukhara Solar PV Project prepared by TYPSA from 01/08/2022.
- IBAT PS6 & ESS6 Report. Generated under licence 1781-26131 from the Integrated Biodiversity Assessment Tool on 17 January 2022 (GMT). www.ibat-alliance.org.

The following visits to be Project area have been conducted for data collection and stakeholder engagement:

- Scoping site visit and scoping consultation - 02 and 03 March 2023.
- ESIA data collection visit (including socio-economic survey and valuation survey) – various during May 2023.

- Public hearing (national EIA) - May 2023.
- ESIA public consultation - 31 May to 01 June 2023.

Further site visits connected with disclosure of livelihood restoration obligations have also been performed and described in detailed in the LRP.

The following ESIA field survey work (primary data collection) has been performed in May 2023:

- Twenty-four hours of continuous air quality monitoring at two locations for the following parameters: Nitrogen dioxide (NO_2); Sulphur dioxide (SO_2); Carbon monoxide (CO), TSP (total suspended particles); PM2.5 and PM10.
- Noise - day and night-time noise measurements for two nearest sensitive receptors (NSRs) (project site): one near the residential area, another at the herder's building for 24 hours continuously each location for i) A-weighted equivalent continuous noise level in decibels - LAeq dB(A); ii) minimum and maximum A-weighted sound pressure level in decibels (Lmax (A), Lmin (A).
- Soil quality survey (at four locations) to confirm the composition of the topsoil and the presence of any elevated contaminants.
- Water quality survey at six locations from two existing channels surrounding the site.
- Socio-economic survey at Kirlishon and Kulchovdur communities.
- Biodiversity surveys (botanical, birds, heterology, fish surveys).
- Archaeological survey work (conducted by the Institute of Archaeology).

A summary of the findings is provided in this section. Detailed reports are in Volume III: ESIA Technical Appendix.

5.3 Land Use

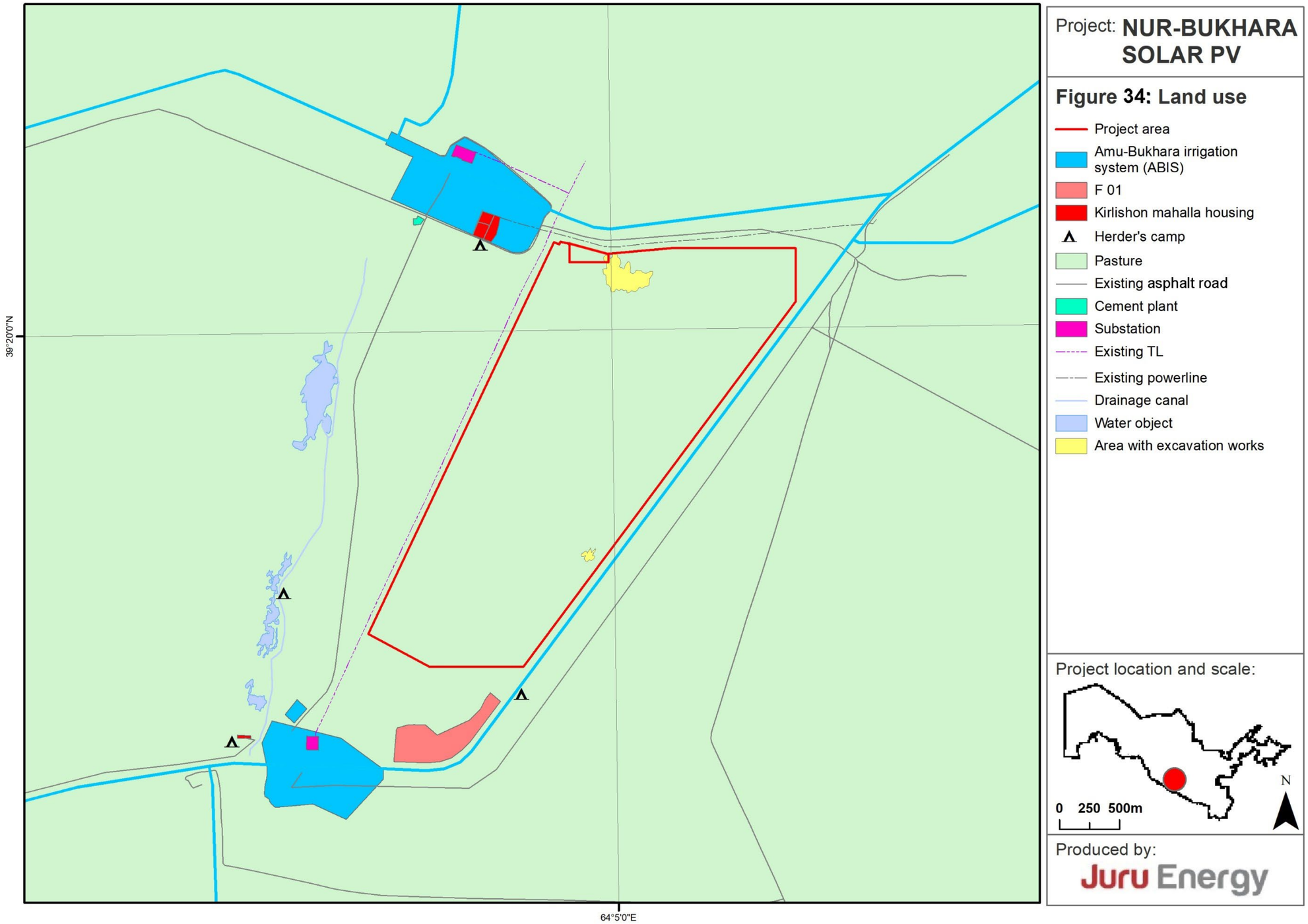
Scoping site observations revealed that the Project site is in a desert area. The area is mainly covered with shrubs, and no crops are grown. According to the face-to-face consultations held with the Alat district municipality Cadastral Department, it was identified that the Project site including the land for the access road and the OHTL, belongs to the Sericulture and Wool Industry Development (SWID) Committee. SWID Committee leases the land to limited liability companies (LLC) and herders to graze livestock under different terms and conditions.

SWID has leased the Project land to a management company called Buhoro Karakol Cluster LLC that has in turn leased it to “Alat Qorakolchilik” LLC, to be used to graze livestock owned by state. The “Alat Qorakolchilik” LLC has set up one lease for the Project land. The holders, one herder and his partner (H1 and H2), have the right to use the land under a land lease agreement.

During the scoping site visits, local community members living in Kirlishon stated that they informally (i.e., without a lease from the SWID Committee) use the Project land for grazing their livestock seasonally at the northern part of the Project site: during the spring months of March, April and May.

Some local community members have constructed temporary structures such as herder camps and stables that are only used during certain times per year from March to October. Figure 34 provides an overview of the Project land use.

Figure 34: Land use



A total of 20 ha of land located outside the southern boundary of the Project site is used by Farmer (F01). The farmer commutes from Alat district in his private car to undertake agricultural activities. The farmer uses water from the ABIS canal to irrigate land, using his private pump (located outside the Project site boundary).

In March, April and May, the land may be used to graze cattle and a temporary stable for the cattle and a herder camp (not within the Project footprint) was observed. According to the consultations held with the farmer, he plans to build permanent structures (stables) and start a cattle business.

Figure 35: Photo of farmland outside of the Project footprint

Figure 36: Photo of temporary stable outside the Project footprint

Figure 37: Photo of pump

Figure 38: Excavated area located north of the Project site

Figure 39: Excavated area located south-east to the Project site

Two quarry areas (for gypsum) were identified during site walkovers with evidence of historical surface excavation works According to telephonic consultations with the local municipality, the excavated area was used for soil extraction for historical construction activities. No current quarrying activity was observed. No further instances of authorised quarrying activity have been verified through consultation with the Ministry of Mining Industry and Geology of the Republic of Uzbekistan (refer to Volume VI: SEP for letter).

The existing overhead transmission line (OHTL), "Karaku'l 500 SS" - "Hamza-2 SS" routes along the western border of the project site. The Project substation will connect to this existing line as described in Chapter 2.

Figure 40: Existing OHTL

Figure 41: Existing OHTL crossing the irrigation channel

The Project site is surrounded by the ABIS Canal, which the Amu Bukhara Irrigation Systems department manages. During consultations with local community members, it was identified that canal water is used for drinking, as the household settlement at the Khamza-1 pumping station (eight households) is not supplied with piped / mains potable water. It is important to note that canal water is also used for irrigation.

Informal fishermen who do not have special permission for fishing in the canal were also observed during site observations, and it is suspected that people use the channel for swimming as well, but it was too cold at the time of the site visit to identify swimmers.

Figure 42: Informal fishing activities in the canal

Figure 43: Amu Bukhara Canal

A concrete batching plant belonging to China National Technical Import and Export Corporation (CNTIC) is located north of the Project site approximately 1 km from the Project boundary. This company is engaged in reconstruction activities at the Khamza-1 substation. Reconstruction works started in 2019 and are expected to last until Q4 of 2024. Near the batching plant, a temporary workers' camp was also identified. It accommodates approximately 130 CNTIC workers who work at the concrete batching plant and on the renovation of the Khamza-1 substation.

Figure 44: Photo of the batching plant

Figure 45: Workers temporary accommodation

Site visit consultations identified that the Khamza-2 sub-station is being renovated by the China National Nuclear Corporation ("CNNC"), and the renovation works are expected to be completed in Q4 of 2023. Another temporary workers' accommodation is located near the Khamza-2 substation and accommodates approximately 70 Uzbek workers and 40 Chinese workers.

The reconstruction and renovation work at both substations utilise water from the ABIS canal. The Ministry of Water Resources of the Republic of Uzbekistan is responsible for renovation works.

Figure 46: Khamza-2 station

Figure 47: Workers' temporary accommodation

5.4 Physical Overview

5.4.1 Climate

Uzbekistan has an arid and continental climate characterised by large variations in temperature within days and between seasons. Large parts of the country (79% by area) feature flat topography either in the form of semi-desert steppes or desert zones, including desert areas in the far west that have formed due to the drying of the Aral Sea.

The majority of the territory of Uzbekistan is attributed to a moderate climate zone. According to the criteria of the UNESCO world map of desertification and the UN convention to combat desertification, the country has an aridity index from 0.03 to 0.20, categorising it as an arid region

subject to intensive desertification and droughts. The southern part of the country is located in the arid subtropical climate zone. In the west, the climate is sharply continental with dry, hot summers and relatively cold snowless winters and a moisture deficit, with a significant excess of evaporation over precipitation. The remaining south-eastern areas have a continental climate, including the area covering the largest cities of Tashkent and Samarkand, and contain high mountains forming part of the Tien-Shan and Gissar-Alai Ranges[26]. In general, temperature ranges vary across the country. Uzbekistan's desert regions can reach maximum temperatures of 45-49°C, while minimum temperatures in the southern parts of the country can drop as low as -25°C [27].

Alat district has a mid-latitude desert climate (Classification: BWk), characterized as cold and semi-arid. The district's yearly temperature is 20.19ºC, which is 2.52% higher than Uzbekistan's averages. Alat typically receives about 11.91 millimetres (0.47 inches) of precipitation and has 27.79 rainy days (7.61% of the time) annually[28].

The TYPSA scoping report provides data on the project site's climatology obtained from the stations located close to the site. The climate data was obtained from the Central Asia Temperature and Precipitation Data, which was operated by the National Snow and Ice Data Centre (https://nsidc.org/data/G02174/versions/1)[29].

Figure 48: Average monthly statistics of air temperature and precipitation

Parameter	Jan.	Feb.	Mar.	Abr.	May.	Jun.	Jul.	Aug.	Set.	Oct.	Nov.	Dec.	Year
Temperature(°C)	1.9	4.5	9.8	17.2	23.3	28.8	30.9	28.7	22.8	15.4	8.8	4.1	16.4
Precipitation (mm)	22.4	18.7	31.0	22.2	8.5	0.4	0.3	0.1	0.6	5.2	12.0	17.6	139.1

Source: IFC, TYPSA, 2022. Environmental and Social Scoping Report – Bukhara Solar PV Project

The bar chart below shows monthly precipitation and temperature variability for the project site[30].

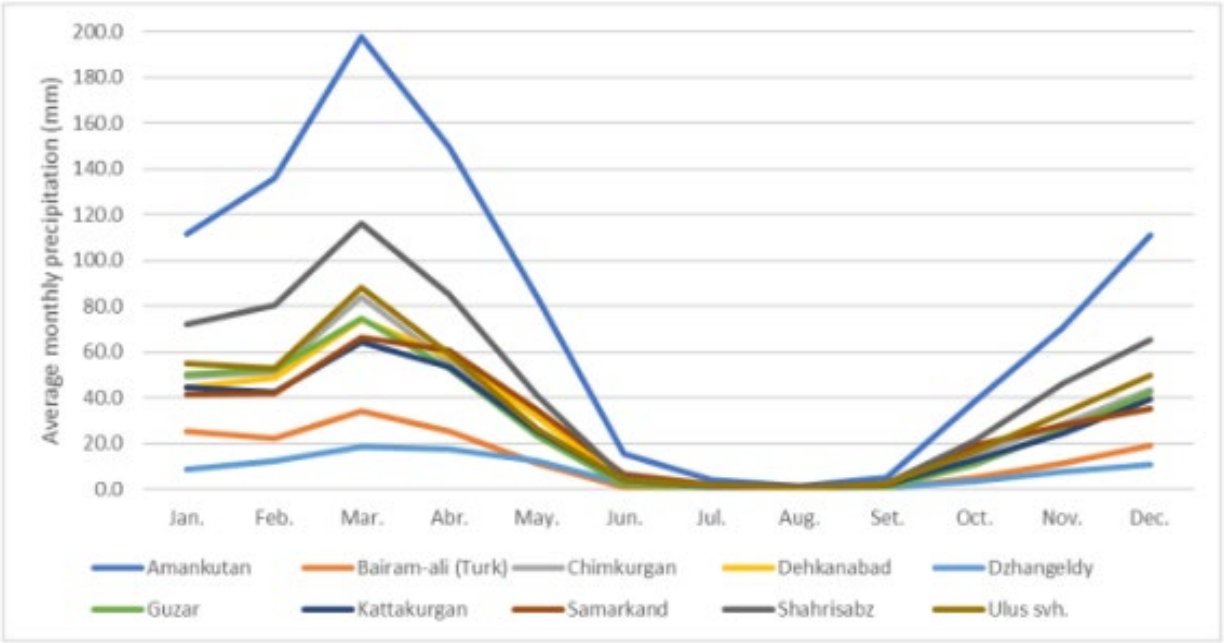
[26]]https://climateknowledgeportal.worldbank.org/sites/default/files/2021-09/15838-Uzbekistan%20Country%20Profile-WEB.pdf
[27] https://tcktcktck.org/uzbekistan/bukhara/dzhankel-dy
[28] Alat, Bukhara, UZ Climate Zone, Monthly Averages, Historical Weather Data (tcktcktck.org)
[29] IFC, Typsa, 2022. Environmental and Social Scoping Report – Bukhara Solar PV Project
[30] TYPSA Hydrology and Hydraulic Report.

Figure 49: Average monthly precipitation and temperature variability at the project Site

Source: IFC, TYPSA, 2022. Environmental and Social Scoping Report – Bukhara Solar PV Project

Precipitation data for ten meteorological stations is shown in the next graph depicting very dry summers with most of the precipitation occurring between December and May[31].

Figure 50: Average monthly precipitation for 10 stations.



Source: IFC, TYPSA, 2022. Environmental and Social Scoping Report – Bukhara Solar PV Project

5.4.2 Climate projections

Uzbekistan is exposed to a range of weather-related extreme events, including dust storms, mudflows, floods, drought, and avalanches and is significantly threatened by climate change, with serious risks already in evidence[32]. Historical trends indicate an increasing average temperature of

[31] IFC, Typsa, 2022. Environmental and Social Scoping Report – Bukhara Solar PV Project

[32] World Bank's Overview of Climate Change Activities in Uzbekistan (October 2013) https://openknowledge.worldbank.org/bitstream/handle/10986/17550/855660WP0Uzbek0Box382161B00PUBLIC0.pdf?sequence=1andisAllowed=y

0.13°C per decade between 1901 and 2013, rising more steeply (0.51 °C per decade since 1983) with a temperature increase greatest at low altitudes and more prevalent during the winter months.

The average number of days with a maximum of 40°C in the central part of the Kyzylkum desert has increased from 10 days in the 1950s to more than 20 days in 2016[33] [34]. Uzbekistan climate projections, based on the Projections of the World Bank Climate Change Knowledge Portal, are as follows[35]:

- Increase in annual mean temperature of 1.3 to 2.1°C by 2030, 1.8 to 3.3°C by 2050, and 2.0 to 5.4°C by 2085.
- Increase in annual maximum temperature of 2.1 to 6.3°C and increase in minimum temperature of 2.2 to 5.6°C by 2085.
- There will be an increase in long-lasting heat waves from three to nine days by 2030, between four and 17 days by 2050, and between six and 43 days by 2085.
- Anticipated change in total annual precipitation ranges from a decrease of three per cent to an increase of 12 % by 2030 and a decrease of 6 % to an increase of 18 % by 2085, with most projections showing an increase.
- Likely increased precipitation between November and April, with precipitation in other months remaining stable or decreasing slightly.
- Dry spells are expected to grow longer by up to four days by 2085.
- An overall increase in arid conditions due to changing precipitation patterns and increased temperatures.
- Increase in the intensity of heavy rain events by 3 to 11 % and frequency by 7 to 36 % by 2030, and in intensity by 7 to 23 % and frequency by 12 to 74 % by 2085. [36,37]
- The number of hot days in Uzbekistan to increase by 28.6 days by 2040-2059, under a RCP 8.5 scenario.
- The number of tropical nights (minimum temperature above 20°C) is projected to increase over 31 days by 2040-2059, under a RCP 8.5 scenario[38].

5.4.3 Air quality

Soil conditions of the territory are fixed and semi-fixed sandy soil, making the site prone to dust generation. No anthropogenic sources (e.g., campfires) of air pollution within 500 m of the Project site except fugitive gas emissions arising from vehicle emissions on the adjacent road (to the north) were identified. Some short-term construction works are ongoing at both water pumping stations,

[33] Climate Service Center Germany. 2016. Climate-Fact-Sheet: Uzbekistan.
[34] http://www.un-gsp.org/sites/default/files/documents/tnc_of_uzbekistan_under_unfccc_english_n.pdf The 3rd National communication of the Republic of Uzbekistan under the UN Framework Convention on Climate Change. Tashkent 2016.
[35] https://www.climatelinks.org/resources/climate-risk-profile-uzbekistan Uzbekistan Climate risk profile, (17/02/2022)
[36] Climate Service Center Germany. 2016 (https://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/index.php.en)
[37] Tashkent. 2016. Third National Communication of the Republic of Uzbekistan Under the UN Framework Convention on Climate Change.
[38] RCP 8.5 is a high emission scenario also referred to as “business as usual”.

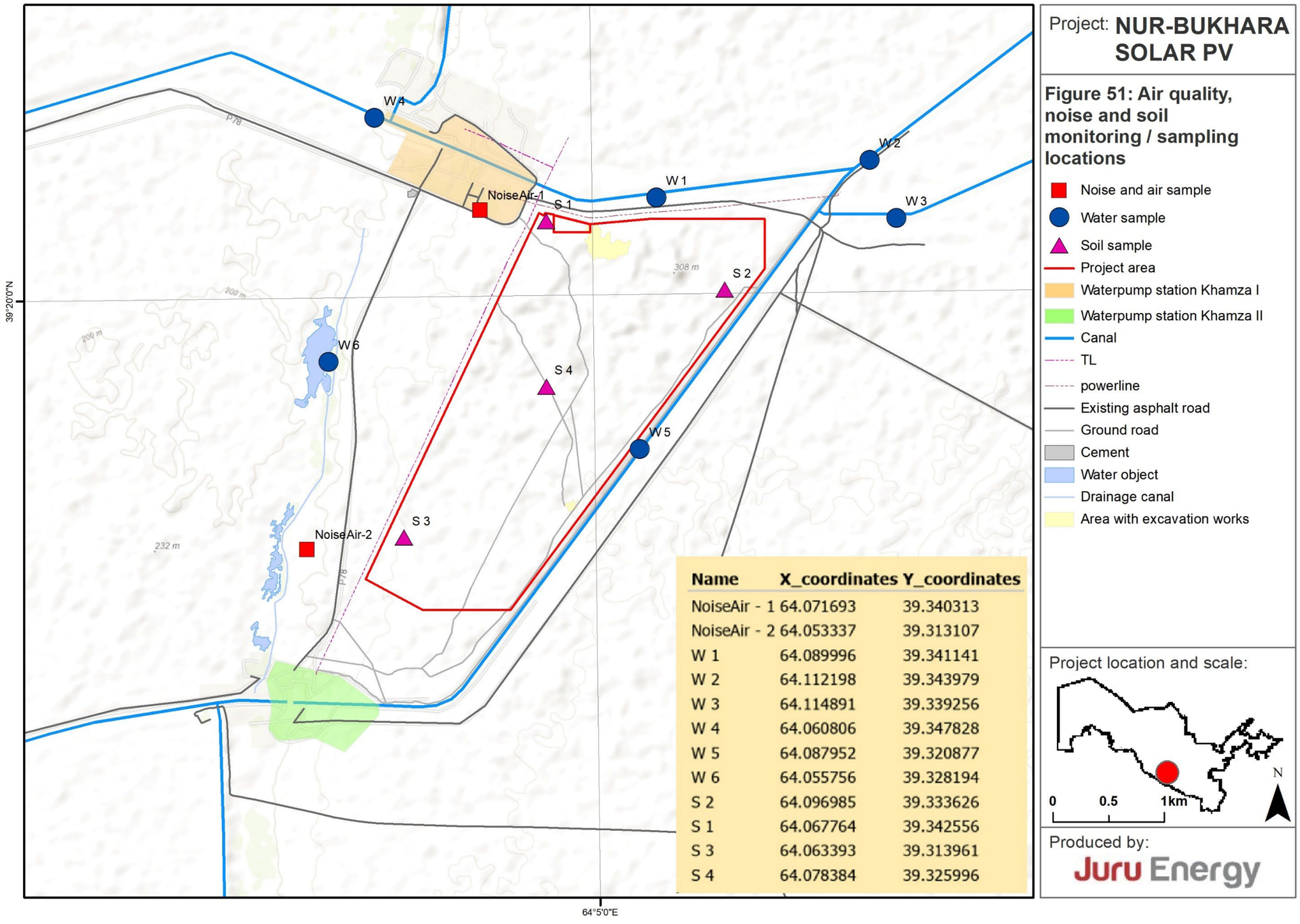
and a temporary concrete batching plant approximately five kilometres from the site's northern boundary. No visible plume or dust deposition is noted from the batching plant site.

Continuous air quality (AQ) monitoring for carbon monoxide, carbon dioxide CO_2), nitrogen oxides (NO & NO_2), sulphur dioxide (SO_2), and particulate matter (dust) ($PM_{2.5}$, and PM_{10}), was carried out from 07 April 2023 to 08 April 2023 at the two nearest receptors, as described in Table 15 and illustrated in Figure 51. A full description of the survey is provided in Volume III: ESIA Technical Appendix. The results are summarised in Table 16.

Table 15: Receptor locations for AQ monitoring

Location	Description	Coordinates Latitude	Coordinates Longitude
AN 1	The location is close to the existing substation Khorezm 1 and nearby community (488 m)	39.340312°	64.071697°
AN 2	A measurement point is located at herder`s building (560 m)	39.313105°	64.053337°

Figure 51: Air quality, noise and soil monitoring / sampling locations



Name	X_coordinates	Y_coordinates
NoiseAir - 1	64.071693	39.340313
NoiseAir - 2	64.053337	39.313107
W 1	64.089996	39.341141
W 2	64.112198	39.343979
W 3	64.114891	39.339256
W 4	64.060806	39.347828
W 5	64.087952	39.320877
W 6	64.055756	39.328194
S 2	64.096985	39.333626
S 1	64.067764	39.342556
S 3	64.063393	39.313961
S 4	64.078384	39.325996

Project: **NUR-BUKHARA SOLAR PV**

Figure 51: Air quality, noise and soil monitoring / sampling locations

- Noise and air sample
- Water sample
- Soil sample
- Project area
- Waterpump station Khamza I
- Waterpump station Khamza II
- Canal
- TL
- powerline
- Existing asphalt road
- Ground road
- Cement
- Water object
- Drainage canal
- Area with excavation works

Project location and scale:

Produced by:
Juru Energy

Table 16: Summary of air quality data for 24 hr. measurement per location (in µg/m3)

Location		AN 1	AN 2	AN 1	AN 2
Date		07:00-23:00	07:00-23:00	23:00-07:00	23:00-07:00
Time Period		15 min	15 min	15 min	15 min
CO	**avg**	0	0	0	0
CO	**max**	0	0	0	0
CO_2	**avg**	702.04	702.96	720.45	701.22
CO_2	**max**	719.44	741.52	730.48	715.76
NO	**avg**	0.8	0.07	0	0
NO	**max**	9.28	2.21	0	0
NO_2	**avg**	24.94	27.97	12.24	19.35
NO_2	**max**	37.67	44.12	14.48	22.27
SO_2	**avg**	0	0	0	0
SO_2	**max**	0	0	0	0
$PM_{2.5}$	**avg**	5.71	19.14	4.35	4.01
$PM_{2.5}$	**max**	17.05	38.19	5.39	22.22
PM_{10}	**avg**	19.75	156.89	12.79	96.45
PM_{10}	**max**	58.99	353.52	16.03	189.31

The average NO concentration is higher during the daytime period for both locations, while the maximum NO concentration is higher during the daytime period for AN1. The average and maximum NO_2 concentrations are higher for AN 2 than for AN 1, especially during the daytime. No baseline concentrations exceed national or international standards (daily). There are no elevated levels of CO or SO_2.

The $PM_{2.5}$ and PM_{10} concentrations significantly differ between the locations and periods. The average and maximum $PM_{2.5}$ and PM_{10} concentrations are higher for AN 2 than AN 1, especially during the daytime; this is likely related to dust generated by animals who were grazing in the vicinity at the time of monitoring (refer to Volume III: ESIA Technical Appendix). The maximum PM_{10} concentration for AN 2 during the day is very high, reaching 353.52 µg/m^3.

5.4.4 Noise

No industrial noise sources within 500 m of the project site exist. Noise generated in connection with the batching plant (approximately 5 km from the project boundary) and vehicles entering and exiting the batching plant are not audible at the Project site. There are two operational water pumping stations located approximately 550m north of the site, which may provide intermittent noise emissions during abnormal operating conditions. Other noise sources include vehicles using the R78 road to the north and west and agricultural activities on and adjacent to the proposed site, e.g., from grazing animals. Some short-term construction works are ongoing at both water pumping stations, which may temporarily add to the baseline noise characterisation of the area. These are due to be complete by the end of 2023/early 2024.

Twenty-four-hour noise measurements (LAeq, LAmax, LAmin, LA10, LA90.) were taken using an unattended noise meter Class 1 (Type 1) per IEC 61672-1 at the two NSRs described in Table 15 and Figure 51. A full description of the survey is provided in Volume III: ESIA Technical Appendix. The

results are summarized in Table 17. The results indicate that all baseline noise levels are below noise standards for residential areas (as defined in Chapter 2). For AN1, temporary construction works for modernising the existing Khamza-1 pumping station were accountable for increased peaks. At AN2, herding activities and animal noises were responsible for elevated background noise levels.

Overall, the measurements suggest that location AN 1 has higher noise levels during the day than at night, while location AN 2 has relatively consistent noise levels throughout the day and night, with slightly higher noise levels during the day. The differences between the LAmax and LAmin values indicate the variability in noise levels over the measurement period.

Table 17: Summary of average Noise values for 24 hr. measurement per location (10-minute intervals)

Location	Date	Measurement interval	LAeq, [dBA]	LAmax, [dBA]	LAmin, [dBA]	LA90, [dBA]	LA10, [dBA]
AN 1	07:00-23:00	10 min	49.57	67.21	36.73	40.76	50.89
AN 2	07:00-23:00	10 min	38.03	55.18	30.74	32.68	39.40
AN 1	23:00-07:00	10 min	38.26	52.18	31.09	33.54	5.31
AN 2	23:00-07:00	10 min	39.45	52.04	34.56	36.13	41.76

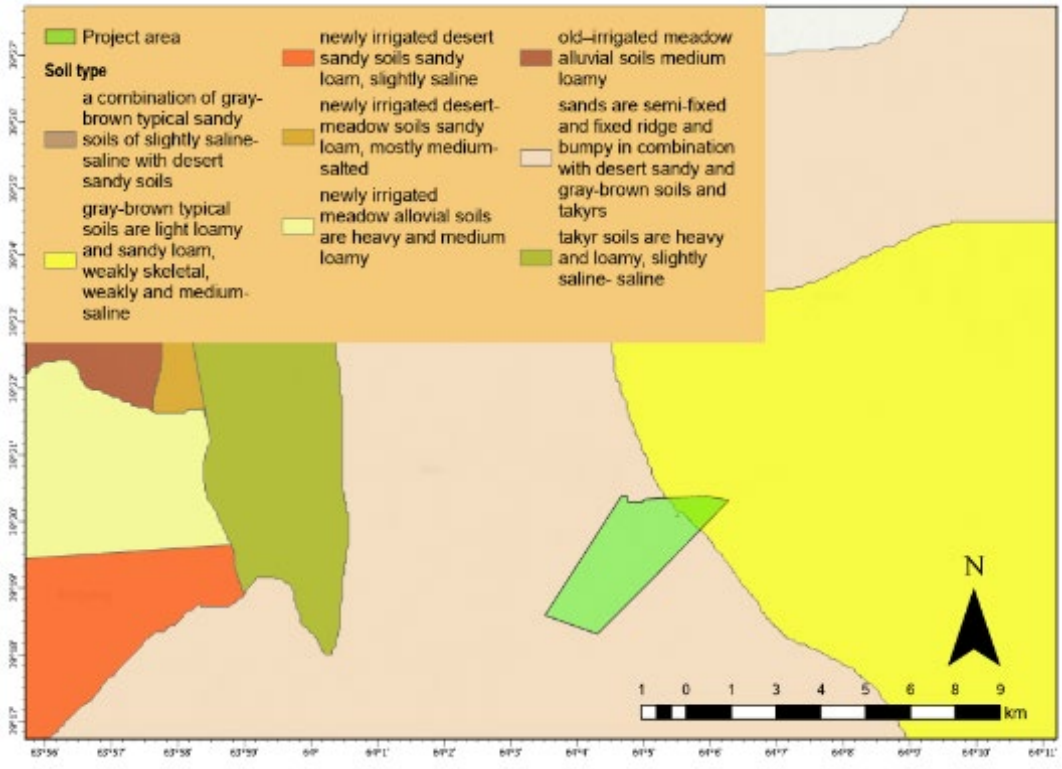
5.4.5 Soils and topography

The site is located on a plateau close to the Turkmenistan border, in an area considered topographically smooth, with a west-facing slope at the western side and surrounded by one large hydraulic structure on two sides (north and east) (ABIS canal). The relief is primarily flat, undulating-hilly due to the roughness of the bedrock relief and, partly, the development of the aeolian cover. The elevation along the working area ranges from 219 m to 237 m above sea level (asl). Two soil layers are noted to occur at the site:

- Sandy soils of slightly saline desert soils (semi-fixed sandy soils)
- Light loamy and sandy loamy, weakly skeletal, weakly and medium-saline (weak-fixed soils)

The soil types are presented in Figure 52.

Figure 52: Soil profile for the project area



Source: Institute of Soil

A soil survey was performed in May 2023. The methodology and results are presented in full in Volume III: ESIA Technical Appendix. Figure 53 shows the locations and coordinates of the sampling points.

Figure 53: Soil and water sample locations

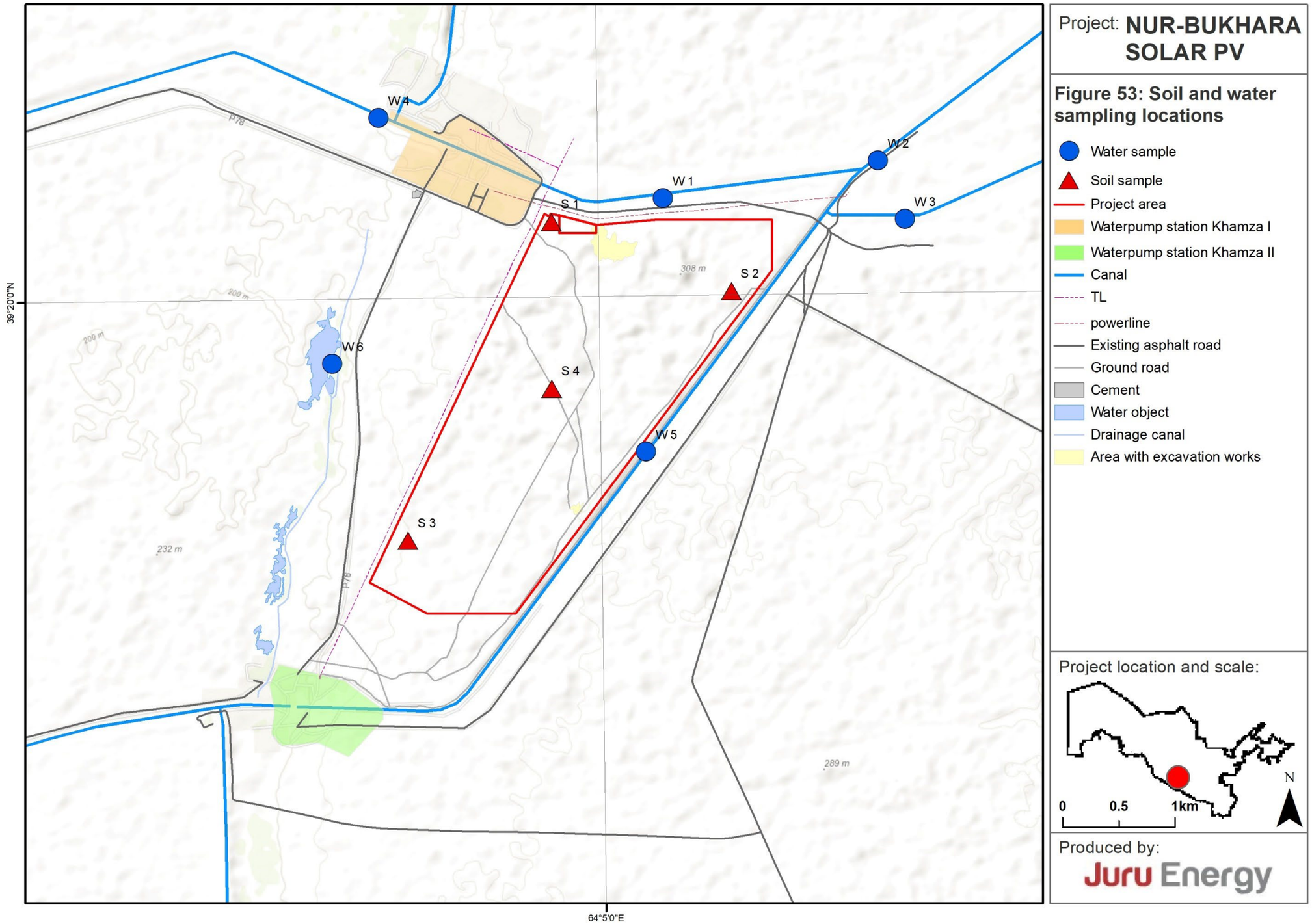


Figure 54: Soil sampling

Visual observation at all the soil sampling locations confirmed slightly brown sandy soil derived from ancient alluvium. The variation in vegetation cover, as described in section 5.6.4, is dominated by native psammophilous shrubs of the region which play a key role in maintaining the structure of the soil.

Visual observations did not show any signs of contamination. Soil pH ranged from slightly alkaline to alkaline (somewhat saline), although outside the range for sodic soli. In all the samples analysed, the concentration of heavy metals, including nickel (Ni), chromium (Cr), zinc (Zn), and copper (Cu), exceeds the maximum permissible concentration (MPC) set by national standards. These metals are classified as moderately hazardous substances according to national averages. However, concentrations of these metals are still below the permissible international intervention thresholds, such as Dutch intervention or target values.

The analysis of all the samples revealed elevated levels of lead, ranging from 1700 mg/l at sample location one to 700 mg/l at sample location four, equating to three and 1.5 times the Dutch intervention target.

According to the literature review, soil contamination by heavy metals is one of the major environmental concerns linked to pesticide use in irrigation water, as well as industrial and geological operations. Thus, heavy metal pollution has been commonly observed in the Bukhara oasis, more precisely, in the borderlands between the sandy desert of Kyzylkum and the irrigated area in the lower reaches of the Zarafshan River basin[39]. Other research on the impact of the gas industry on soil quality and heavy metal contamination indicates that in the Kashkadarya province, exceedances of lead content up to eight or nine times the maximum permissible concentrations (MPC) and of nickel content up to two times[40]. For the Project area, evidence of historical quarrying operations (mainly excavation of ground and sand for construction purposes) is visible during site surveys, which may be the reason for the high metal content. Naturally elevated levels of heavy metals are also likely, as evidenced by the elevated levels being noted in all four sampling locations despite the distances between each location.

The amount of petroleum product found in the soil was almost negligible. Despite the presence of petroleum products as an indicator of the sanitary condition of the soil, general MPCs for them are not established by sanitary regulations for exogenous chemical substances in the soil. Similarly, Dutch soil and groundwater contamination standards do not have a petroleum products value

[39] Toderich, Kristina; Khujanazarov, Timur; Aralova, Dildora; Shuyskaya, Elena; Gismatulina, Liliya; Boboev, Hasan. Ecosystem Services and Community-Based Approaches to Wastewater and Saline Soils Reclamation in the Drylands of Uzbekistan.

[40] Kholikulov S, Yakubov T, Bobobekov I. The Effect of Gas Industry Waste on Heavy Metals in Soil. Journal of Ecological Engineering. 2021;22(9):255-262. doi:10.12911/22998993/141365.

standard. In this case, the MPC established by the Bukhara Department of Ecology and Nature Protection was not exceeded.

Table 18: Results of the soil analyses

Name of parameters	Locations				The lower limit of detection	MPC in mg/kg	Dutch intervention standards[41]	
	S1	S2	S3	S4				
							Value	Target Value
pH	7.97	8.14	8.30	8.30	1-14	-	-	-
Nitrate (NO3), mg/dm^3	17.0	19.00	20.00	21.00	10-6 mg/kg	130.0 (gross content)	-	-
Sodium (Na), mg/kg	9000	10000	10000	9200	40 mg/kg	-	-	-
Potassium (K), mg/kg	15000	16000	15000	15000	80 mg/kg	-	-	-
Chromium (Cr), mg/kg	52.0	62.0	61.0	59.0	1.0 mg/kg	6.0	180	-
Manganese (Mn), mg/kg	230	470	290	230	20 mg/kg	1500.0 (gross content)	-	-
Iron (Fe), mg/kg	14000	18000	15000	15000	60 mg/kg	-	-	-
Nickel (Ni), mg/kg	20.0	48.0	41.0	20.0	1.0 mg/kg	4.0	100	35
Copper (Cu), mg/kg	18.0	18.0	17.0	17.0	1.0 mg/kg	3.0	190	36
Zinc (Zn), mg/kg	40.0	37.0	32.0	40.0	1.0 mg/kg	23.0	7200	140
Cadmium (Cd), mg/kg	0.081	0.064	0.060	0.016	0.005 mg/kg	-	13	0.8
Mercury (Hg), mg/kg	<0.03	<0.03	<0.03	<0.03	**	2.1	36	0.3
Lead (Pb), mg/kg	1700	1300	1000	700	0.1 mg/kg	32.0	530	85
Petroleum products, mg/kg	0.013	0.011	0.014	0.011	0.01 mg/kg	0.1-1.0[42]	-	-

Footnote: Highlighted cells denote exceedances of national standard or international standard (also highlighted)

5.4.6 Geology and seismicity

Uzbekistan's territory is related to the active tectonic structure of the lithosphere of Western Tian-Shan, the development of which results in the formation of deep fault networks[43]. The collision of

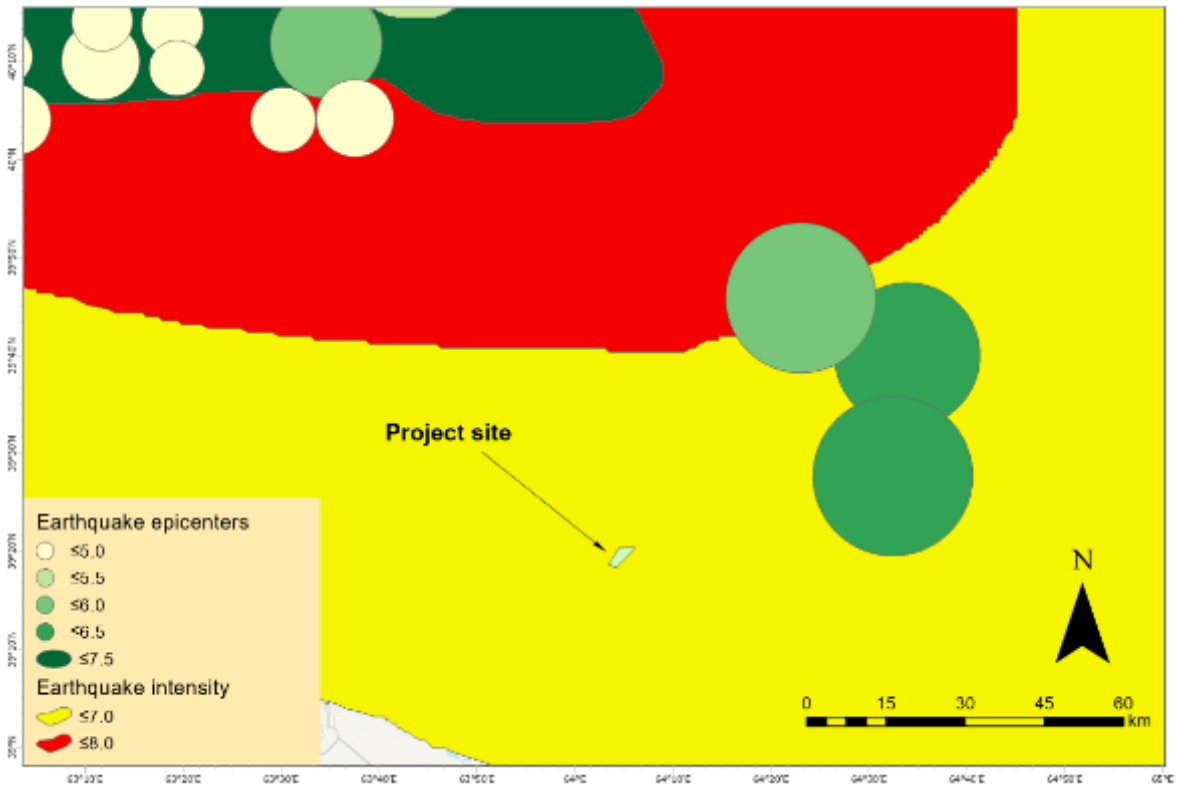
[41] Dutch Standards for Soil and groundwater Contamination (2013).

[42] According SanPIN standards value.

[43] Mavlyanova N. et al (2004): Seismic code of Uzbekistan. Proceedings 13th World Conference on Earthquake Engineering Vancouver, B.C., Canada. August 1-6, 2004. Paper No. 1611

the Eurasian and Indian plates has led to a region of substantial crustal compression in Central Asia. As a result of this convergence and shortening of the crust, deformation occurs, leading to frequent high-magnitude earthquakes throughout the region, including the eastern part of Uzbekistan. A considerable amount of the territory of Uzbekistan (including the Project site) belongs to the zone of seismic intensity VII (very strong) (MSK scale) (see Figure 55)[44]. In Uzbekistan and surrounding regions, several earthquakes with magnitude ML ≥ 7 and intensity of ground shaking in epicentral areas I0 with 9–10 points by MSK-64 scale have occurred in historical and modern times. Figure 55 shows the complex variant of Mmax constructed based on seismological design techniques. In most cases, values of Mmax calculated by seismological and seismotectonic methods fit each other (deviations were in the range of 0.2–0.4 magnitude units), confirming the reliability of made constructions[45]. The site is located in an area which may experience earthquakes with magnitude ML ≥ 7.

Figure 55: Seismic zoning near the project area



Source: E&S Scoping report by TYPSA

5.4.7 Surface water

There are no permanent or temporary surface water features (including wells or boreholes) within the Project site. The Project site is bordered by the ABIS canal (70m from the fence line at the closest point) and a drainage channel and pond network about one kilometre west of the Project

[44] Medvedev-Sponheuer-Karnik (MSK) scale. This is similar to the Modified Mercalli Intensity scale used in the United States and Europe.

[45] Complex of general seismic zoning maps OSR-2017 of Uzbekistan (Turdali Usmanalievich Artikov, Roman Solomonovich Ibragimov)

site (as described earlier)[46]. Water quality sampling was conducted in the ABIS canal on 04 April 2023. The samples were taken at six locations (Figure 53), including upstream of the entrance to the pumping station Khamza I (W4) and from the outlet from the station (W1) as well as in four further branches of the ABIS canal that surround the Project site. The full methodology and results are presented in Volume III: ESIA Technical Appendix.

All six water samples were slightly alkaline with high electrical conductivity, with the highest conductivity of 20,685 µS/cm observed in sample W6 (Table 19). The concentration of chromium in samples W1 and W3 is slightly higher than the MPC by 0.01 mg/l (for drinking water)[47], however, the MPC of water for irrigation usage is not exceeded. The MPC of dissolved oxygen (DO) for sample 6, slightly exceeds the standard by 0.3 mg/l, which is acceptable according to the classification in the national standard (drinking). The lowest level of DO was found in sample W6, possibly due to the high salt content. The Sodium Adsorption Ratio was approximately 2 mEq/L for almost all locations, indicating that the water was non-sodic. However, the W6 contains a high amount of Na, which could not be detected due to the higher detection limit. The levels of heavy metals in all samples were low and did not exceed the MPC (for fishery or irrigation).

[46] Further information about how affected communities use the ABIS canal is provide in the socio-economic overview.
[47] These parameters were also compared to the MPC for drinking water, since the nearest community's water from the ABIS canal use this water for drinking. The Project will not use the ABIS canal for any water needs.

Table 19: Results of water analysis

Name of parameters	Locations						MPC O'zDSt 950:2011	Fishery water use[48]	Irrigation water use
	W1	W2	W3	W4	W5	W6			
pH	8.07	8.15	8.15	8.14	8.17	8.17	6-9	6.5-8.5	6.5-8.5
Turbidity, mg/dm³	0.03	0.03	0.03	0.03	0.03	0.03	1,5	-	-
Electrical conductivity µS/cm	1246	1233	1240	1236	1227	20685	-	-	-
Dissolved Oxygen mgO_2/dm³	5.9	6.5	7.05	4.9	6.5	3.7	>4[49]	-	-
Total Suspended solids, mg/dm³	9.435	8.375	13.475	8.925	10.675	3.895	0.25/0.27[50]	15	50
Cr^{3+} mg/dm³	0.061	0.040	0.063	0.041	0.027	0.042	-	-	-
Cr^{6+} mg/dm³	0.00	0.00	0.00	0.00	0.005	0.005	-	0.001	0.1
Cr (total) mg/dm³	0.061	0.040	0.063	0.041	0.032	0.047	0,05	-	-
Arsenic (As) mg/dm³	0.0029	0.0030	0.0027	0.0027	0.0024	0.0044	0.05	0.05	0.1
Aluminum (Al) mg/dm³	0.067	0.076	0.055	0.076	0.083	0.0076	0,2(0,5) ****	-	-
Cadmium (Cd) mg/dm³	0.00038	0.00074	0.0001	0.0001	0.00013	0.0002	0.001	0.005	-
Copper (Cu) mg/dm³	0.0025	0.0031	0.0026	0.0027	0.0023	0.03	1.0	0.001	1
Nickel (Ni) mg/dm³	0.0047	0.0047	0.0045	0.0043	0.0043	0.012	0.1	0.01	0.2
Lead (Pb) mg/dm³	0.000085	0.000097	0.000071	0.000082	0.000010	0.000011	0.03	0.03	0.2
Zinc (Zn) mg/dm³	0.00720	0.00550	0.00630	0.00590	0.00550	0.0031	3.0	0.01	5
Petroleum products, mg/ dm³	0.011	0.012	0.012	0.011	0.012	0.011	0.05	0.05	0.3
Sodium (Na) mg/dm3	110	110	100	100	97	>	-	-	-
Calcium (Ca)	180	170	160	160	160	480	-	-	-
Magnesium (Mg) mg/dm3	26	25	23	23	22	120	-	-	-

[48] SanPiN RUz № 0318-15

[49] According SanPIN № 0318-15 standards value.

[50] According SanPIN standards value.

5.4.8 Groundwater

According to the TYPSA scoping report, the groundwater level regime on the Project site is determined by the flow regime of the ABIS canal and the associated intensity of irrigation for crop fields. Groundwater was not encountered during the survey period (July 2021)[51], up to the maximum investigated depth of 15 meters. Further groundwater studies will be conducted by the EPC contractor during the pre-construction survey work to confirm the groundwater profile at the site.

5.4.9 Archaeology

Based on the outcomes of consultations held with relevant stakeholders[52] and site walkover observations during the scoping and ESIA phase (March-May 2023), no features of tangible or intangible cultural heritage significance were identified on the Project site. Following consultation and a site walkover with the Institute of Archaeology (IoA), a confirmatory survey was performed by the IoA in May 2023. The full report prepared by the IoA is provided in Volume III: ESIA Technical Appendix; a summary of the findings is provided below.

5.4.9.1 Survey methods

The IoA undertook archaeological observation and trial excavation across six representative locations at the Project site. GPS equipment and Locus Map[53] software was also used in the search and exploration process (. Samples of soil layers were also taken to identify archaeological remains. Topographic maps were used to record the location of any remains. The maps were accompanied by explanations showing which search methods were used and what results were obtained at each location. At each pothole (a small or trial excavation), a record of its composition and stratigraphy was taken. All archaeological finds were placed in labelled bags and taken to the laboratory for cleaning, inventory, and analysis.

During the inspection of the area, scattered fragments of pottery were found at six points (Table 20), and several ruined modern sheep pens. The IoA dug potholes where the pottery was found to identify if there were any traces of archaeological use of the site.

[51] Hydrology and Hydraulic Report prepared by Typsa from 21/09/2021.
[52] Consultations with Cultural heritage agency and Institute of Archaeology
[53] Locus Map is a multifunctional navigation application that adds advanced online and offline GPS capabilities to Android devices.

Figure 56: Soil and water sample locations

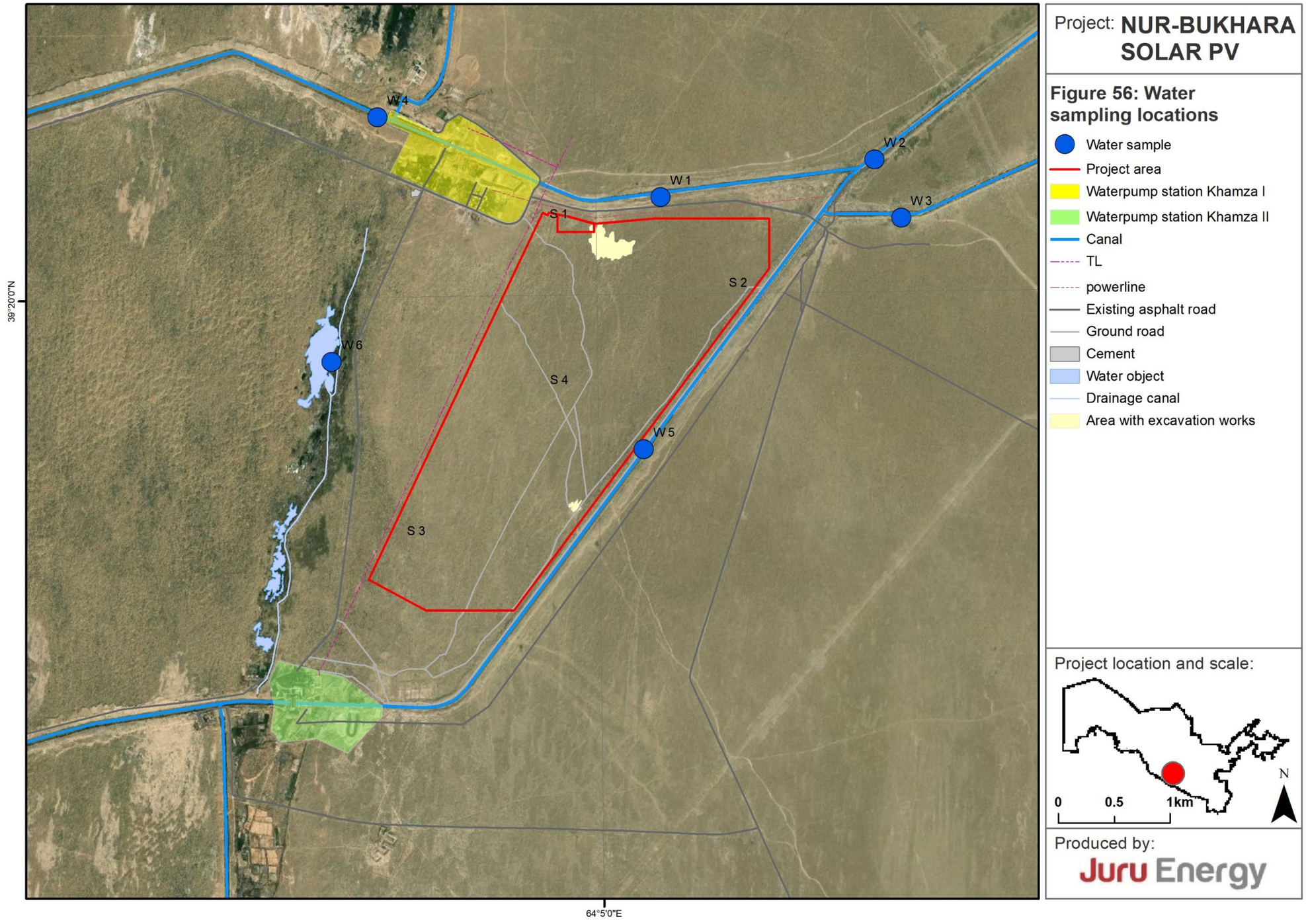
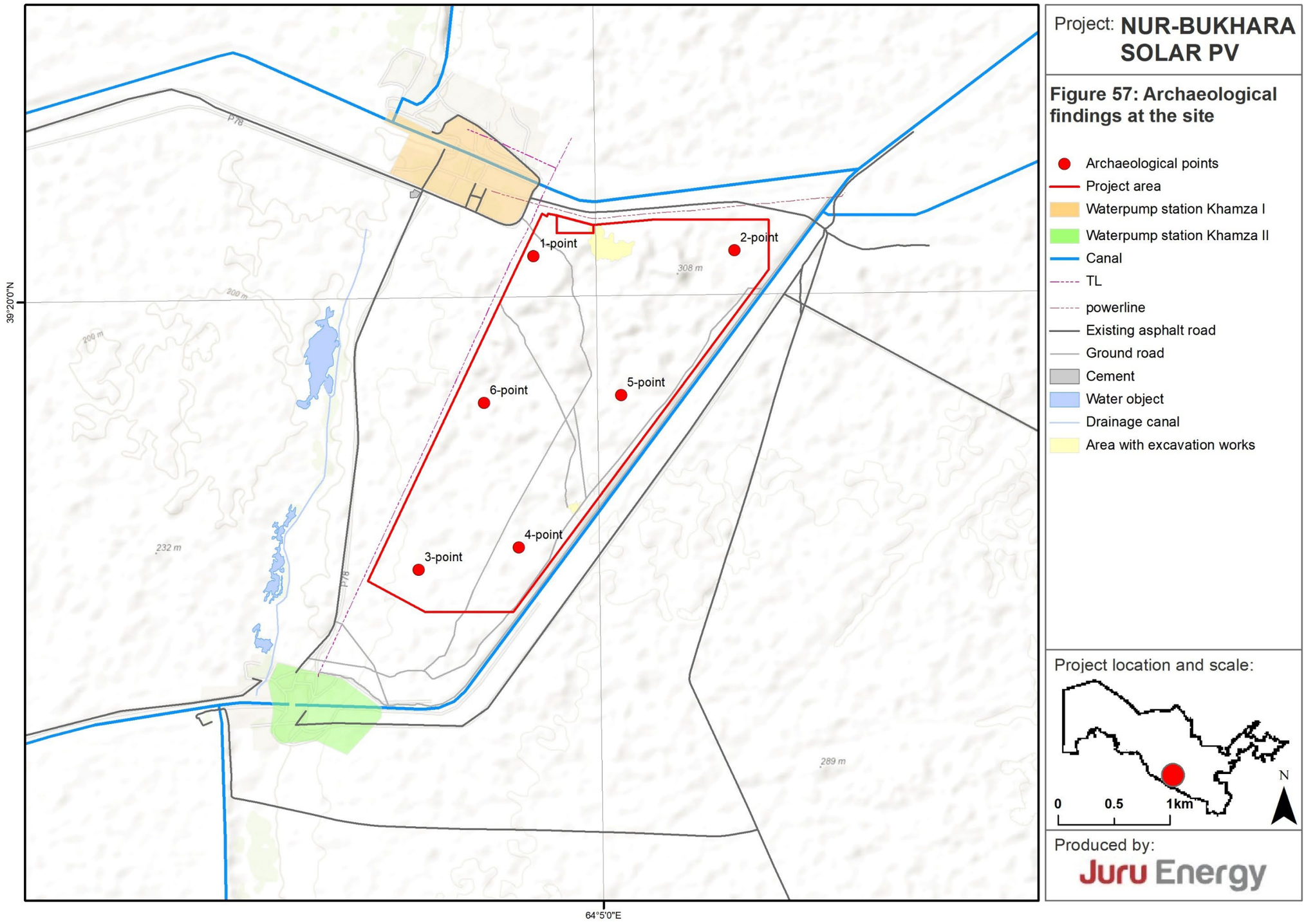


Figure 57: Archaeological findings at the site



5.4.9.2 Description of findings.

The majority of items identified on site are ceramic fragments, mainly made up of unglazed pottery scattered in small amounts across the area. These earthenware vessels were fragments of ceramic flasks, jugs/pitchers and pots. It should be noted that the study area is highly saline and considered unsuitable for the production of pottery or building products; therefore, these items are likely to have been transported from somewhere else[54].

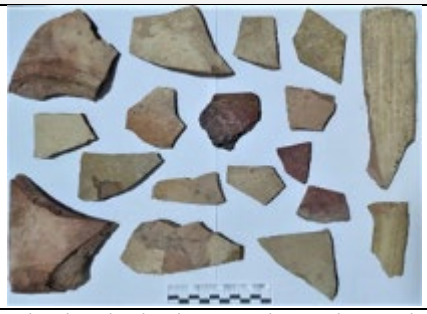
The fragments identified show that the jugs/pitchers were made on a quickly rotating potter's wheel. They were ovoid in shape, with reddish shades in cross-sections. The clay was mixed with sand and fine limestone. The outside of the pitchers was decorated with ribbon using a special tool before firing. The handle was thick and attached to the shoulder and flange. Similar types of pitchers can be traced to the 16th-19th centuries in Bukhara and were used as kitchen utensils.

The pots were curved and were made by hand. The shape was spherical, with a flat base formed by a thin triangular tray. The clay has a porous red tint and contains coarse fireclay, crushed limestone and vegetable additives. Table 20 provides a summary of the findings.

[54] High quality clay for ceramic production in Bukhara oasis was mined at Karnab Sukhoyty mine (Rakhimov, 1961. S.34).

Table 20: Summary of findings – archaeological survey

№	Photo	Description	Condition of object	The field it was found	Time period object was made
1		Ceramic	Fragment	Point 1	Middle Ages (V-VIII centuries)
2		Ceramic	Fragment	Point 2	Middle Ages (V-VIII centuries)
3		Ceramic	Fragment	Point 3	Middle Ages (V-VIII centuries)
4		Ceramic	Fragment	Point 4	Middle Ages (V-VIII centuries)
5		Ceramic	Fragment	Point 5	Middle Ages (V-VIII centuries)

№	Photo	Description	Condition of object	The field it was found	Time period object was made
6		Ceramic	Fragment	Point 6	Middle Ages (V-VIII centuries)

Source: Archaeological and exploration works carried out (April-May 2023) in the areas of Krilishon mfy, Olot district, Bukhara region to determine archaeological monuments, IOA, May 2023.

No traces of settlement were found in the area where the ceramics fragments were identified. Findings suggest that local shepherds may have left the ceramics fragments behind because they had become unusable during migration. This fits with known land uses, as the land has only been used seasonally by nomadic people or for grazing animals.

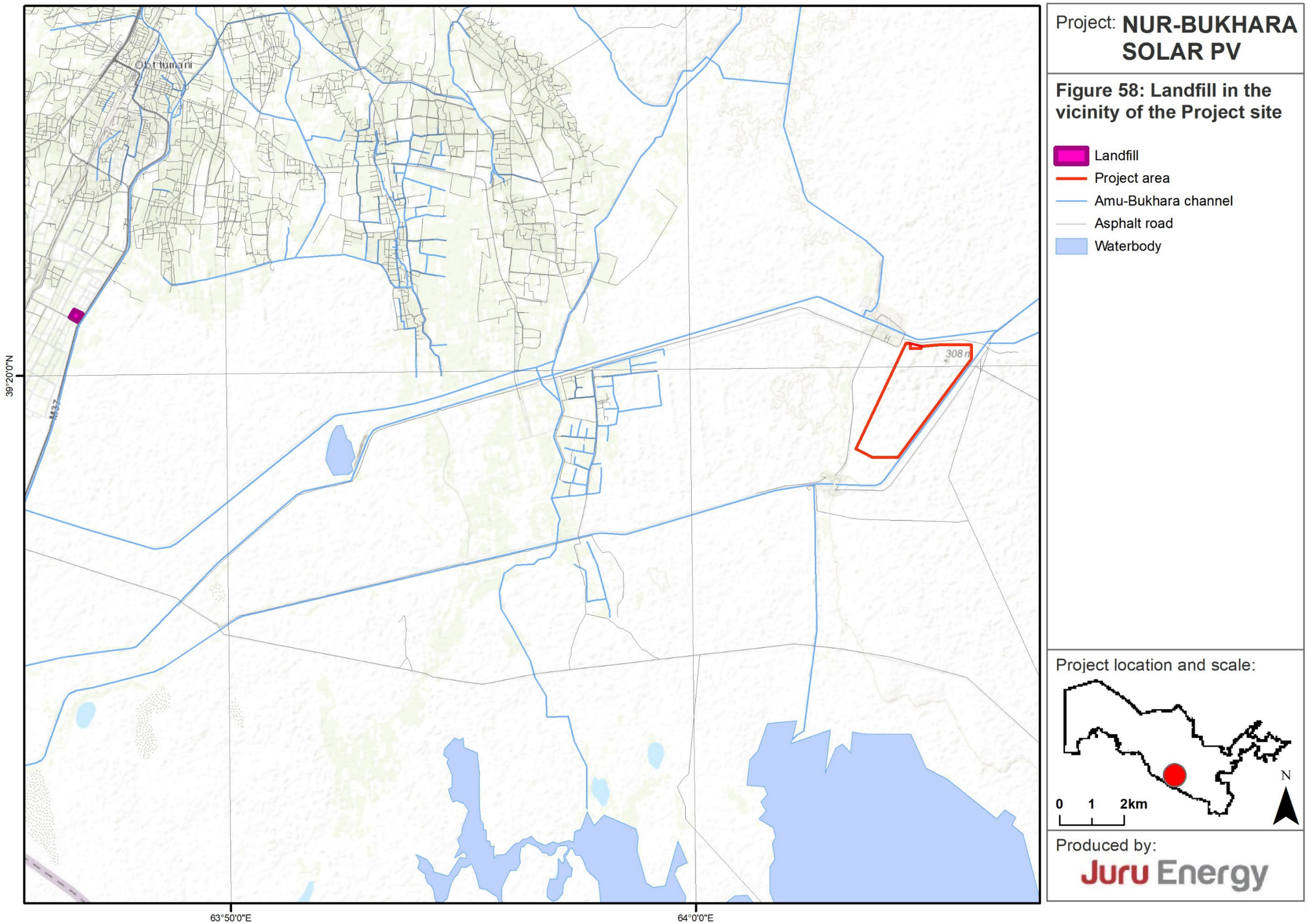
Following the archaeological survey, the IoA made the following conclusion:

- No archaeological monuments or objects of archaeological significance were identified.
- Archaeological artefacts of the XI-XII and XVIII-XIX centuries A.D. were found and removed from the site. But no other archaeological or material remains were identified during the pothole excavations to study the cultural layers.
- Due to the large size of the Project construction area, excavations must be conducted under the constant supervision of an Archaeologist during excavations following the Law of the Republic of Uzbekistan No. UP-229 "On Protection and Use of the Objects of Archaeological Heritage".

5.4.10 Waste services

Telephone consultations with the local municipality representatives revealed that the nearest landfill to the Project site is located approximately 36 km to the north-west of the Project site. The total area of the landfill is 6.24 ha. Half of the landfill is owned by Bukhara region “Toza Hudud” State Unitary Enterprise, while Olotobod LLC owns the other half. Only household waste is currently disposed of at the landfill. The nearest hazardous waste disposal options are in Bukhara.

Figure 58: Landfill in the vicinity of the Project site



5.4.11 Water and sanitation services

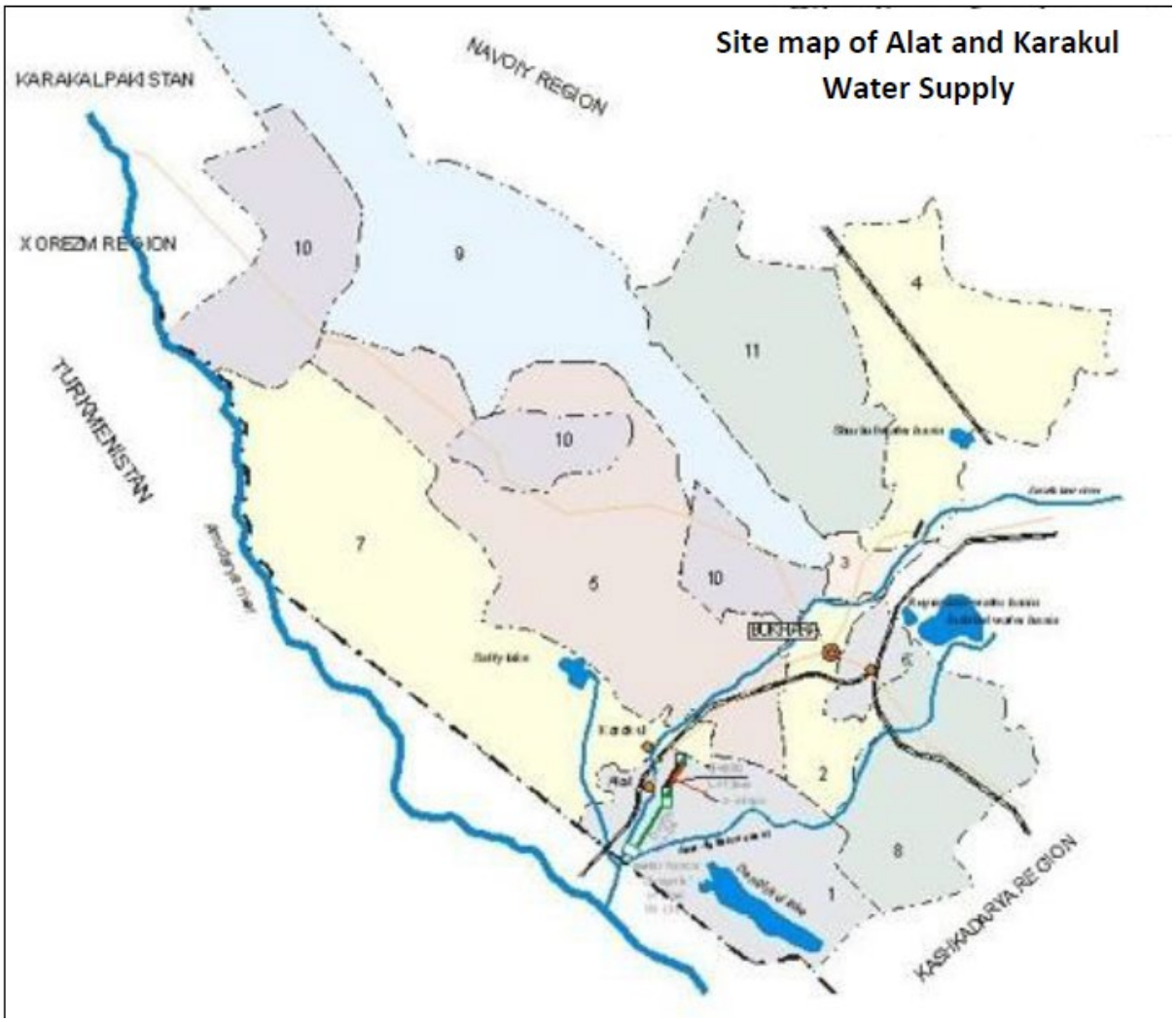
The Bukhara region (including Alat District) which covers approximately 39,400 km^2 and hosts a population of 1.9 million people, has been identified as a priority region for developing water and sanitation infrastructure and tourism in recent years. Water supply and sanitation is managed by a regional water and sanitation company under a national water and sanitation asset management corporation (Bukhara Regional State Unitary Enterprise (*Bukhara Suv Taminoti*) under JSC UzSuvtaminot).

Water for the Alat district originates from the Amu-Bukhara canal via the Dvoinik-Alat freshwater trunkline (see Figure 59). Following the recent World Bank and GOU funded Alat-and-Karakul-Water-Supply-Project[55], to increase the capacity of the system (49,000 m^3/day), upgrade existing pipelines and expand the distribution system to more households, piped water supply to Alat district now meets water demands in most households in Alat District, except the following seven rural settlements in Alat District, one of which is an affected community – Kirlishon**[56].** The socio-economic survey (described in detail in section 5.5) notes that for supply of potable water, 83.8% of households in the Kirlishon community and 98.9% of households in the Kulchovdur community have access to a centralized water supply, and very few households (the remaining 1.1%) in Kulchovdur stated that they have access, but it only works intermittently. Centralized water supply is not available in 16.2% of surveyed households in the Kirlishon community. The Jiydali settlement (located within the Khamaza 1 compound) that is considered part of Kirlishon community, uses water from the ABIS canal for all purposes, even for drinking (it is assumed that they undertake some form of simple purification before drinking – potentially boiling or homemade filter). They have built small furrow systems from the ABIS canal to their houses. Community members close two sides of the furrow and keep the water for some time, removing the water from the furrow system in buckets. All the respondents use the ABIS canal for irrigation purposes.

[55] World Bank Alat and Karakul Water Supply Project 9 https://documents1.worldbank.org/curated/en/940341654548012860/pdf/Uzbekistan-Alat-and-Karakul-Water-Supply-Project.pdf) (completed 2021)

[56] Other communities not full connected to the water supply system are Karikon, Buralang Eski, Gazmach, Karvok, Khamza 1 and Khamza 2

Figure 59: Alat and Karakul Water Supply overview[57]



The current level of sanitation coverage in Alat district is 52 % for water supply. Centralized sewerage services are currently only accessible to the residents of Bukhara and Kagan cities, with access rates of 55.6 % and 27.6 %, respectively. No municipal connection to the wastewater treatment network is available at the site. The nearest municipal wastewater treatment options are in Bukhara region.

5.4.12 Local road network

A few tracks have been identified within the Project area; these are assumed to have been used by local herders and miners to access the quarrying areas. There is also an unpaved road along the eastern border of the Project site between the ABIS canal and the Project site boundary; it is not intended to use this road for the Project. The main road (R78) is an asphalt road located north of the Project site and is used primarily by workers of the Khamza 1 substation and batch plant to travel to and from their place of work. The nearest local communities typically use the western part of the road to commute to the district centre (Alat City). Therefore, there is a limited amount of traffic currently travelling on the road east towards the site, which will be reduced further once the reconstruction of the Khamza 1 substation has been completed. Local herders also use the road

[57] Alat and karakul Water Supply Project, Bukhara, Uzbekisatn (JWRC, AST), September 2010, NewTap. http://www.jwrc-net.or.jp/aswin/en/newtap

during the grazing period (March to May). Several dirt roads cross the Project site, as depicted in Figure 60. The R78 will be the main external route to the site.

Figure 60: Roads in the area

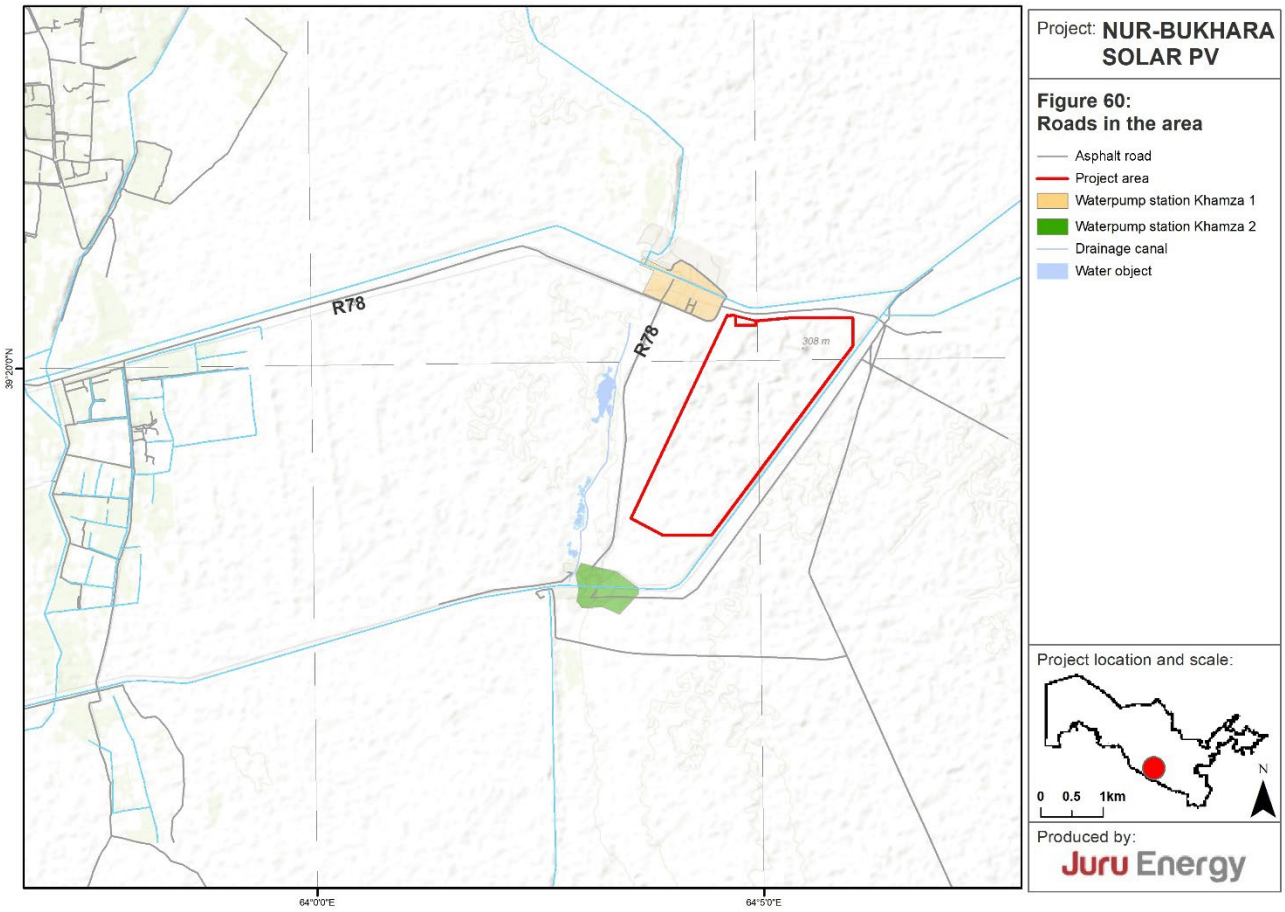


Figure 61: Existing Road used by local community members

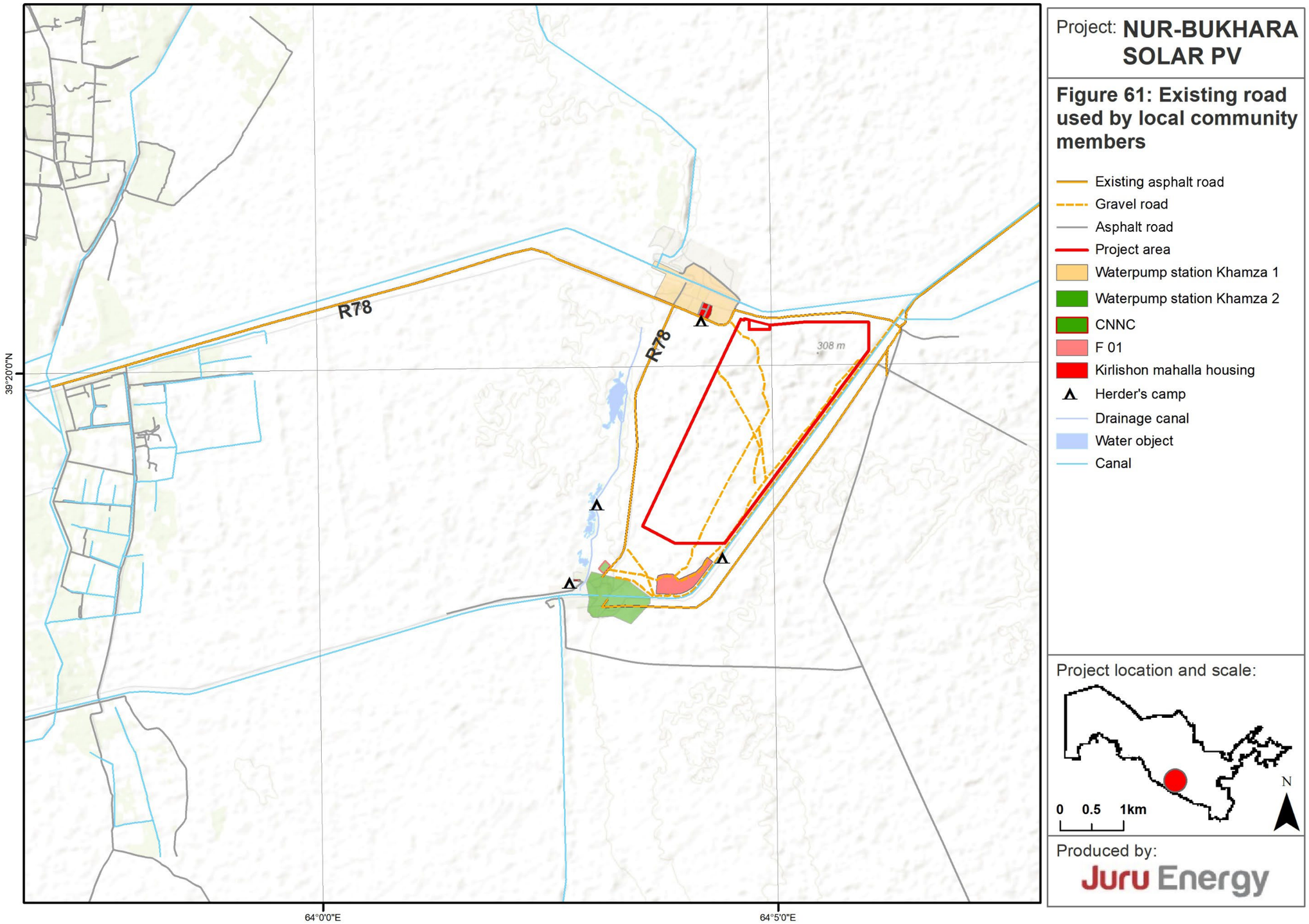


Figure 62: Existing Road used by local community members

Respondents were asked how often they use the road next to the project site. The table below gives information about this.

Table 21: Frequency of usage of the road next to the Project site

	Daily	2-3 times in a week	Once per month	Seasonally	Do not use
Kirlishon	12.2	10.8	6.8	12.2	58.1
Kulchovdur	2.1	6.4	6.4	46.8	38.3
Total	**5.0**	**7.6**	**6.5**	**37.0**	**43.9**

Source: Socioeconomic survey, 2023.

The majority of households do not use the road at all, with more than half (58.1%) of respondents from Kirlishon not using the road, while most of the community members from Kulchovdur (46.8%) use the road seasonally. In Kirlishon 9.5% and in Kulchovdur 4.7% of the respondents have an alternative road they can use, while the remainder do not. A number of roads were mentioned by respondents as possible alternatives.

Feedback received during the ESIA public meeting on 01 June 2023 indicated that the community is concerned with the condition of roads in the area (potholes, cracks, etc.). The paved roads in the region are generally noted to be in poor condition.

5.4.13 Airfields

The closest airfields to the Project site are:

- Bukhara International Airport in Uzbekistan (57 km from the Project site)
- Turkmenabad International Airport in Turkmenistan (60 km from the Project site)

No public airfields were identified within 10km of the project site.

5.4.14 Utility supply and communication network

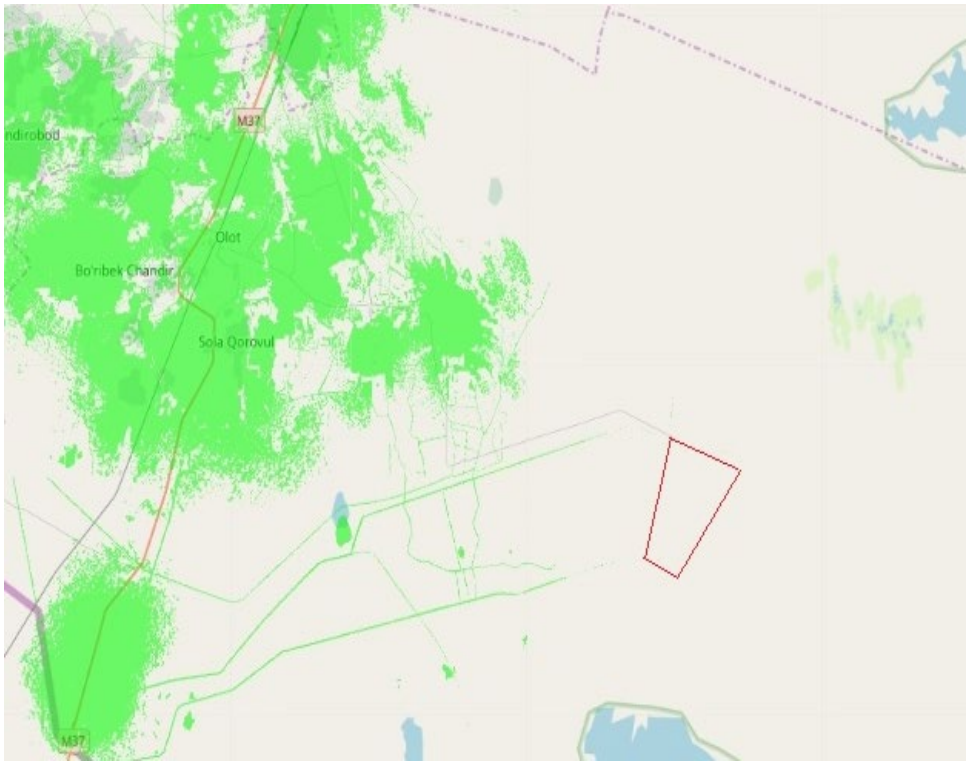
Alat District is equipped with natural gas (administrated by district department Hudud Gas) and electricity supply (administrated by district department of NEGU). Local population is obliged to pay taxes for gas and electricity consumption by established tariffs, i.e., 1m³ of natural gas is 380 UZS (app 0.003USD) and for 1 kV/h of electricity - 295 UZS (0.026). People can pay either for already consumed amount of gas and electricity or pay in advance (for one year/month ahead). There is a certain limit of gas and electricity consumption that is established by authorities in charge. More often than not, if people do not pay for consumed gas and electricity over 3 months then they receive notification to pay.

Both AoI communities have stable internet connection from "Uzbektelekom" JSC and a stable electricity supply maintained by Bukhara MET JSC (the local electricity grid company). Mobile networks in Uzbekistan are available only in villages, and their working zones are not distributed in unpopulated areas such as the Project Site. It is possible to use 3G and 4G in most parts of the Alat district; Figure 63 below represents the coverage areas for Uzmobile as the provider with the best coverage in the AOI.

Figure 63: Mobile network coverage in the Alat district: a-3G, b-4G (Source: https://uztelecom.uz/) (red polygon indicates Project site)

a)

b)



5.5 Socio-economic overview

5.5.1 Introduction

Administratively the Project site is located in Alat District of Bukhara Region (refer back to Figure 2). It is located 24 km southeast of Alat City, close to the border with Turkmenistan which at the closets point lies around 25 km southeast of the Project site. The proposed site is flat and is surrounded by the Amu-Bukhara canal to the North, South and East. The site has existing road access. There are two communities located within 12 km of the Project site.

Kirlishon community is located approximately 10 km north-west of the Project site. However, Jiydali settlement, made up of eight households is considered part of the community, and is located approximately 400 m north of the Project site within the complex of the Khamza 1 substation. The total area of the Kirlishon community is 23,509 ha, and the total number of households amounts to 142 (not including the six households in Jiydali settlement).

Kulchovdur community is located approx. 11 km northwest of the Project site. The total area of the Kulchovdur community is 2,787 ha. The total number of households is 545, according to the information provided by the makhalla. Both of these communities are considered to be directly impacted by the Project ("AOI communities")[58].

Table 22: Survey sampling of AOI communities

No	Name of community	Overall number of households	Proposed number of households for survey (as planned)	Surveyed number of households
1	Kirlishon	142	71	74
2	Kulchovdur	545	190	190
3	Total	687	261	264

There are also two EPC Contractors (China National Technical Import and Export Corporation – CNTIC - and China National Nuclear Corporation – CNNC - with 131 and 110 workers respectively), working at the Khamza 1 and 2 substations. These works will be completed at the end of 2023 (Khamza 2), and the end of 2024 (Khamza 1), resulting in approximately one year of overlap with the Project.

The following section provides a socioeconomic baseline of the Project site, it is based on existing secondary information and the results of the socioeconomic survey.

[58] Nearest communities may benefit from a small amount of employment as a result of the Project.

Figure 64: Location of AoI communities

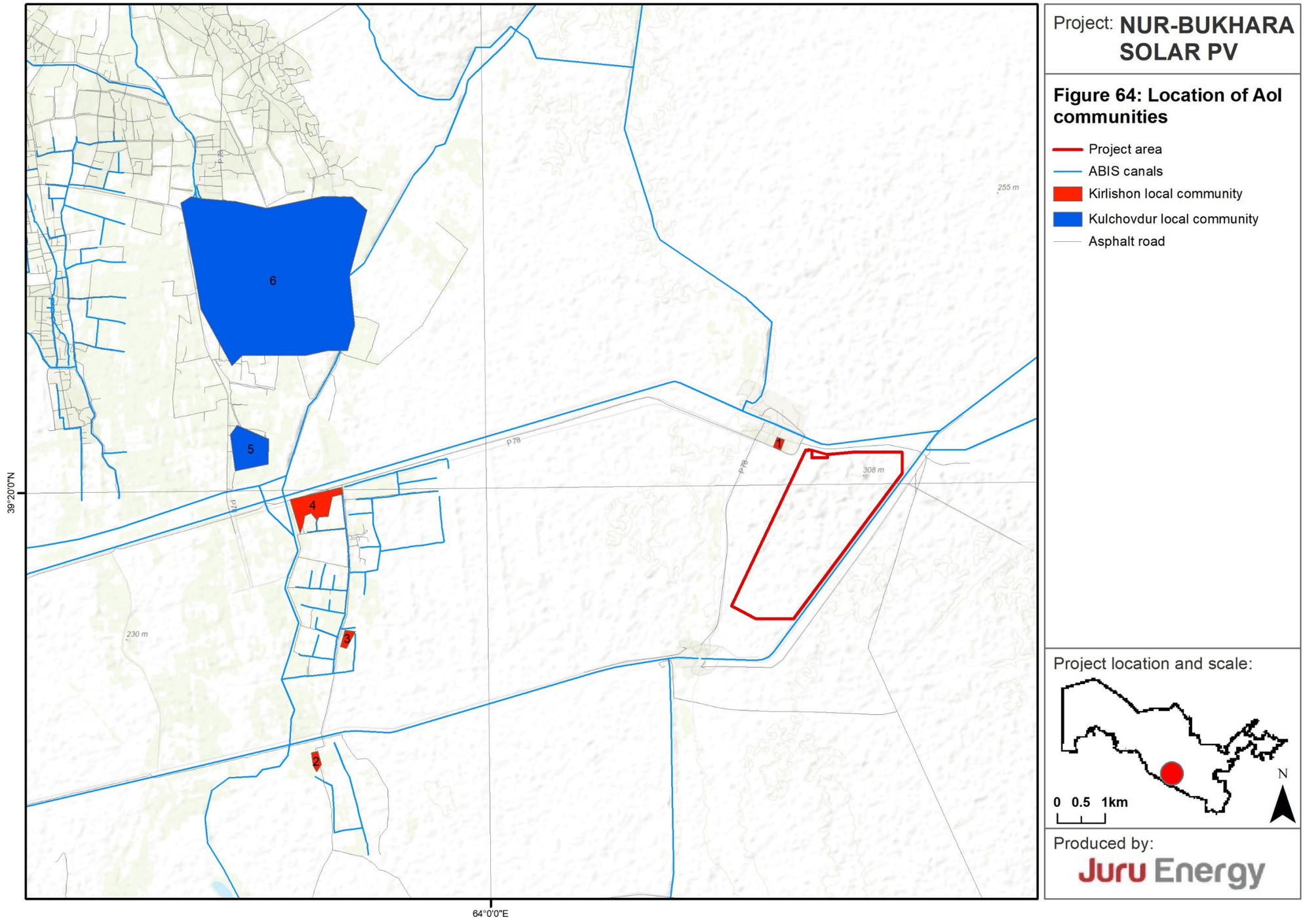


Figure 65: Photo of Jiydali settlement of Kirlishon Community located 400 m north of the Project site

A socio-economic profile of the AOI was developed, through a socio-economic survey of households in the AOI communities, which was undertaken from 17 to 21 April 2023. A total of 190 households in Kulchovdur (approximately 35% of the 545 total households) and 74 households in Kirlishon (approximately 52% of the 142 total households) were surveyed. Table 23 below demonstrates the sample sizes.

5.5.2 Demographics

According to the State Statistics Committee of the Republic of Uzbekistan, at the beginning of 2023 the permanent population amounted to 36,024,900 people. As of January-March 2023, the population of the Bukhara region totalled 2,016,600 people. For the same period the population of the Alat District reached 103,100 people[59]. Alat district is predominantly rural, in January 2023 the urban population of the Alat District totalled 38,700 people (38% of the population) and the rural totalled 64,100 people (62% of the population). It should be noted that the proportion of men and women in the District is equal – 50% each. Table 23 shows that the population of the Kirlishon and Kulchovdur communities were reported to be 669 and 2,636 people respectively in 2022.

Table 23: Population of AOI communities in 2022

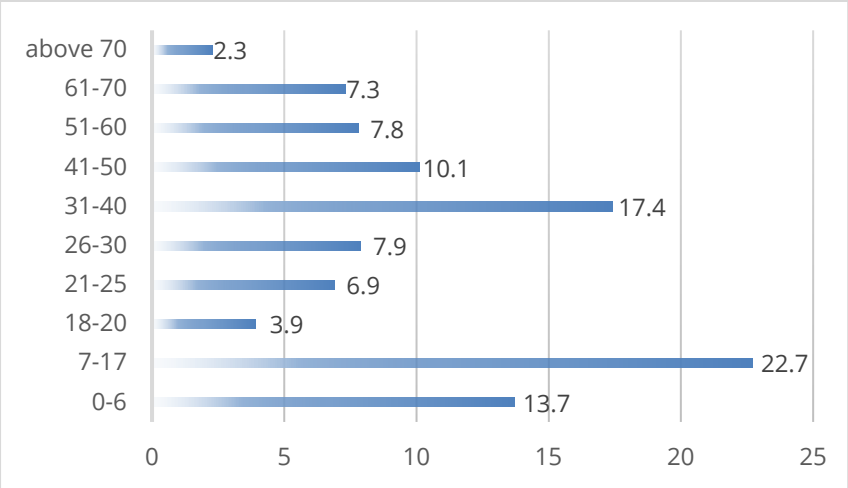
No	Name of community	Total population	Households
1.	Kirlishon	669[60]	142
2.	Kulchovdur	2,636[61]	545
	Total	**3,305**	**687**

[59]https://www.buxstat.uz/uz/?preview=1&option=com_dropfiles&format=&task=frontfile.download&catid=286&id=3322&Itemid=1000000000000
[60] Passport of " Kirlishon " community assembly as of October 1, 2022
[61] Passport of " Kulchovdur " community assembly as of October 1, 2021

Source: Socioeconomic survey 2023.

The gender distribution of the AoI communities, based on survey information showed it is fairly consistent with the District statistics, with slightly more men (50.1%) than women (49.9%). The majority of the households in the surveyed communities are male headed households at 92.8%, with households headed by women making up just 7.2% of all surveyed households. The members of the surveyed households aged between 7-17 years made up the largest individual age group, as shown in Figure 66 below.

Figure 66: Age of surveyed household members[62]



5.5.3 Economy

The agricultural, forestry and fishery sectors are the key industries in Bukhara region, together they make up 9.4% of the total production in the Republic of Uzbekistan. Cotton is the main agricultural crop. However, the region also produces grains, potatoes, fruit and vegetables. Livestock products makes up 48.0% of the total agricultural production. The breeding of black cattle, cows and horses is considered valuable in the region. Between January and December 2022, farms of all categories in the region produced 284,900 tonnes of meat.

Tourism is also an important sector in the Bukhara region's economy. The city of Bukhara, with its well-preserved historic architecture and UNESCO World Heritage Sites, is a popular destination for tourists. As per the annual report of the Statistics Committee, the gross regional product (GRP) for 2022 amounted to 45.8 trillion UZS (~4.0 billion USD)[63] (an increase of 4.4% from the previous year).

The economy of Alat District is primarily based on agriculture (cultivating cotton, wheat, corn, fruits, and vegetables). The cotton and grain industries are considered well-developed sectors. Other key sectors include, livestock farming, the food industry, textiles, consumer goods and

[62] Note: The number ranges are different in this table to allow it to show the number of children (under 18 years), per the norm in Uzbek statistics.

[63] https://www.buxstat.uz/uz/?preview=1&option=com_dropfiles&format=&task=frontfile.download&catid=295&id=3346&Itemid=1000000000000

building materials. The District has deposits of minerals, including limestone, gypsum, and sand which are used for the production of building materials such as cement, concrete, and plaster.

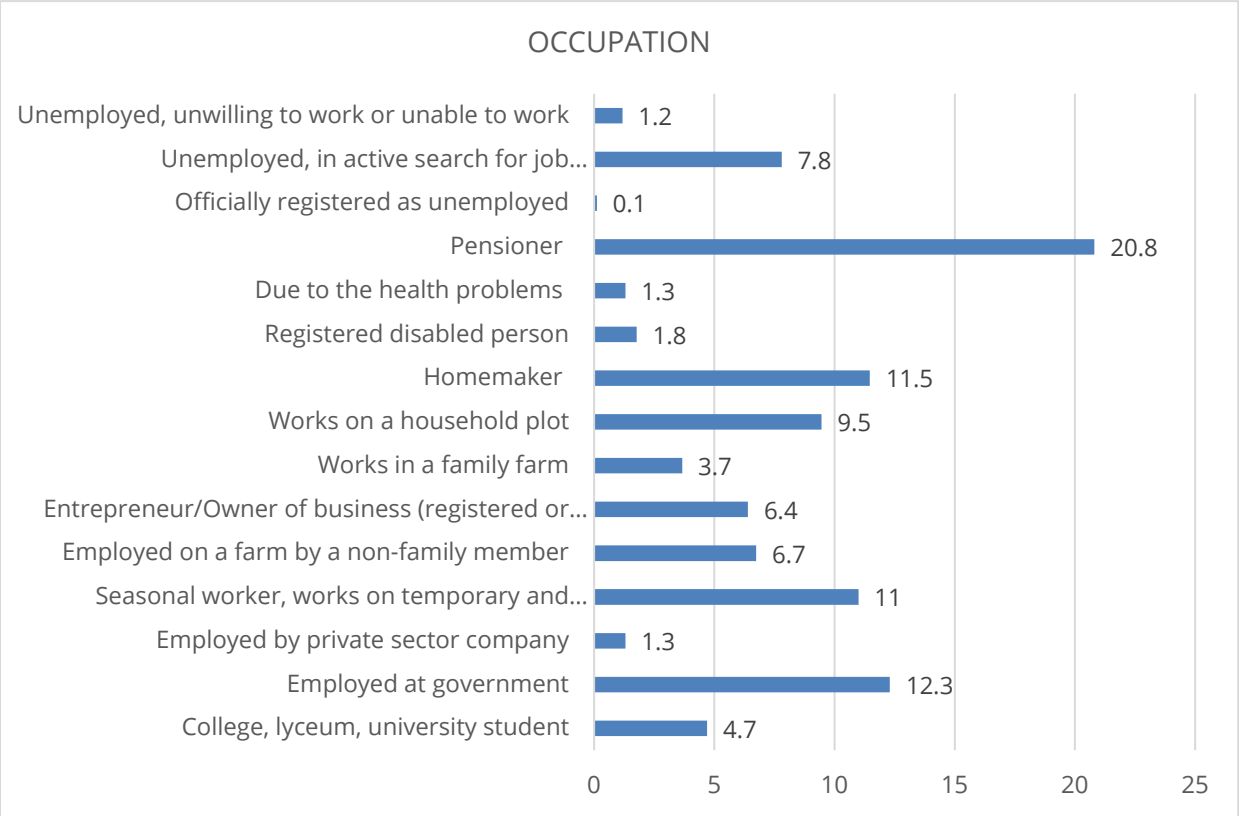
Data obtained as result of consultations with communities of Kirlishon and Kulchovdur revealed that the economy of the Kulchovdur community is almost exclusively reliant on agricultural activities and the Krilishon community is almost exclusively reliant on livestock grazing.

5.5.4 Employment

In Alat District, the total number of people employed in the labour market is 43% of the population. In 2022 there were a total of 377 people who had migrated for work. The majority of economically active people are employed in the agricultural sector (32%), followed by education (12%), industry (9%), construction (8%), commerce, catering, and logistics (7%), health, and social welfare (7%), housing and communal services (5%) and other sectors (20%).

Figure 67 below provides information on the occupation of the household members in the surveyed households. It was revealed that the majority of respondents (20.8%) are pensioners, whereas 12.3% of respondents stated they are employed in the government sector. Entrepreneurs and business owners make up 8% of respondents. Registered unemployed people make up 0.1% of the population while those that are not registered but are unemployed, make up another 7.8%. A total of 11% of respondents reported that they work as seasonal worker (working in temporary and seasonal jobs) while about 9.5% of respondents work on their household farm.

Figure 67: Occupations in surveyed communities



No schoolchildren in the AoI were identified as participating in paid work. A small number of children are involved in un-paid work to assist their households. In Kirlishon community children do not work at all. However, in Kulchovdur community 11.3% of surveyed households stated that their children are active in different household chores. These children work every day between one and seven hours per day with the majority working three to four hours per day (46.2% of children that work).

Approximately 14.1% of the surveyed households stated that they have household members who have migrated to work in other regions of Uzbekistan or abroad. Almost all of the households with labour migrants had only one person that had migrated. The remaining 2.8% of the households with labour migrants had two labour migrants in their households, no households had more than two labour migrants.

Survey respondents were asked the main threats that impact their income, 47.5% of respondents reported that there are no threats (54.9% of respondents from Kirlishon and 44.7% from Kulchovdur), 39.8% of respondents indicated unemployment (with more people from Kulchovdur (42.6%) concerned about unemployment than Kirlishon (32.4%), lack of irrigation water was a concern for 13% of respondents, but this was much more of a concern in Kulchovdur (16.8%) than Kirlishon (2.8%). Respondents were allowed to select up to two answers. Table 24 below provides more information.

Table 24: Main threats that impact income of respondents

	Kirlishon	Kulchovdur	Total
No threats	54.9	44.7	**47.5**
Decrease in prices for agricultural products	0.0	1.1	**0.8**
Lack of irrigation water	2.8	16.8	**13.0**
Rising prices for consumer goods	7.0	7.9	**7.7**
Lack of water in the Amu Bukhara canal	0.0	0.5	**0.4**
Long quarantine time	0.0	1.1	**0.8**
Unemployment	32.4	42.6	**39.8**
Poor state of agricultural land	0.0	2.6	**1.9**
Restrictions on the use of water from the Amu Bukhara canal	1.4	0.0	**0.4**
Pasture cuts	1.4	0.0	**0.4**
Lack of pension	0.0	0.5	**0.4**
Difficult to answer	2.8	2.6	**2.7**

Source: Socioeconomic survey, 2023.

When asked about challenges faced by household members (particularly in their place of work), one third of respondents stated that no challenges were faced (34.1%). Following that the main concerns raised were economic inequality (16.9%), and the lack of opportunity for a career. Respondents from Kirlishon also raised access to public services as a key challenge (16.9%). Respondents were allowed to select up to two answers.

Table 25: Challenges faced by household members in affected communities (%)

	Kirlishon	Kulchovdur	%
Economic inequality	21.1	15.3	16.9
Access to equal opportunity	5.6	6.3	6.1
Lack of respect or harassment (please specify the type of harassment experienced)	5.6	1.1	2.3
Access to public services	16.9	3.7	7.3
No opportunities for career	4.2	18.4	14.6
Limited access for education, professional trainings	8.5	5.3	6.1
Prices for medical services are high	0.0	1.1	0.8
Internet problems	5.6	1.6	2.7
Unemployment	0.0	10.0	7.3
Irrigation water shortage	0.0	0.5	0.4
Difficult to answer	1.4	13.2	10.0
No challenges faced	33.8	34.2	34.1

Source: Socioeconomic survey, 2023.

*total share exceeds 100% as multiple options could be selected

5.5.5 Accommodation, living conditions and household amenities

All of the survey respondents live in a private house, meaning that no one lives in multi-story apartments, and all of them live there all year round. Approximately 98.1% own their own homes, while 1.9% rent. About 90.5 % of the houses are registered (owned) under a male member of the household, and the remaining 9.5 % are registered under a female member (usually the household head).

A total of 74% of Kirilishon community members responded that they have a stable electricity supply all year round, while 15% of respondents stated that the electricity supply is unstable all year round, even in summer, and 11.0 % face some problems with electricity only in winter. In comparison, in the Kulchovdur community, 34.4 % of respondents have a stable electricity supply all year round; 51.3% of respondents stated their electricity supply is not stable all year round, and electricity is unstable in 13.8% of respondents' households. While 0.5% of respondents indicated that sometimes the electricity is turned off.

None of the surveyed households have centralized gas supply. People use gas cylinders as an alternative. There is no centralized heating in place. For heating, 89.4% of households use wood or plant materials, 2.7% use small shrubs and trees from the grazing land (*haloxylon*), and 4.2% use coal. Also, 3.4% use electricity and 0.4% of the households use gas cylinders for heating their houses. Table 26 shows that Kulchovdur is largely reliant on wood and plant materials, while members of Kirlishon community are more likely to use different types of fuel for heating.

Table 26: Source of fuel for heating (%)

	Kirlishon	**Kulchovdur**
Wood or plant materials	82.4%	95.8% (3.7% specified it as *haloxylon*)
Electricity	10.8%,	0.5%
Coal	5.4%	3.7%
Gas cylinders	1.4%.	0

Source: Socioeconomic survey, 2023.

For cooking, gas cylinders are predominantly used (92.8%), while 6.5% of respondents use wood or plant materials. Oil and electricity are used by a small proportion of respondents - 0.4%. In the Kirlishon community, 98.6% of respondents use gas cylinders, while 1.4% use wood or plant materials for cooking. In the Kulchovdur community, 90.5% of respondents use gas cylinders, while wood or plant materials are used by 8.5% for cooking. Oil and electricity are used by 0.5% of respondents.

Kulchovdur community members have more ways of disposing of waste than Kirlishon community members. For both AoI communities, the removal of waste by the state garbage company is the most used method of waste disposal, this is followed by use of designated pits for household waste.

Table 27: Waste disposal methods (%)

	Kirlishon	Kulchovdur	Total of both communities
Removed by the state garbage company	40.5%	35.3%	36.7%
Removed by private waste company	13.5%	3.7%	6.4%
Accepted / collected by the state waste processing company	14.9%	18.9%	17.8%
Special pits in their households for garbage	31.1%	19.5%	22.7%
Waste is burned	0	14.2%	10.2%
Waste is buried	0	7.9%	5.7%
Public trash cans on the street	0	0.5%	0.4%

Source: Socioeconomic survey, 2023.

5.5.6 Land use, agriculture, and natural resources

In Alat District, agricultural land makes up 55% of the district's total area. Almost all (99.3%) surveyed households reported having agricultural land plots (within their communities, not on or near the Project site). Of the total respondents, 89.4% have "tomorka" (household garden plots), while 9.9% have "tomorka" and other areas of land as well. 0.8% of respondents reported that they do not have land. Of the respondents that own land, the total plot area for 91.4% of respondents was up to 0.5 hectares, and the remaining 8.6% own land plots larger than 0.5 hectares. The types of agricultural products respondents grew on their land plots in 2022 are provided in Figure 69 below. Respondents were allowed to select multiple answers.

Of the total number of surveyed households, the majority (245 households or 92.8% of surveyed households) stated that they own livestock. Most of the families own cows, bulls, and poultry. A total of 84.8% of surveyed households (224 households) own cows and bulls, while 73.9% (195 households) have poultry. According to survey results, 46.6% (123 respondents) have sheep and goats, two respondents have camels, and eight respondents own other animals. In 19 households, no livestock or poultry were kept. Survey results showed that although large numbers of households owned animals, it was only in small numbers, with only the majority of poultry owners owning animals in numbers greater than five animals. The statistics are provided in Table 28.

Table 28: Number of households that own livestock in the AOI communities

Type of livestock	%
Cows, bulls	84.8
Lambs, goats	46.6
Camels	0.8
Poultry	73.9
Other animals	3.0
No livestock or poultry	7.1[64]

Source: Socioeconomic survey 2023

[64] Numbers are more than 100% as people were able to select more than one type of livestock.

There are currently no agricultural activities being undertaken on the Project site, except for seasonal grazing of livestock. Survey respondents from the AOI communities were asked if they used the Project site and if so, what they used it for and five respondents (1.9% of all respondents) indicated that they use the Project area, and all of them use this area for seasonal grazing of livestock. All five respondents live in Kirlishon community and no respondents from the Kulchovdur community use the Project site. According to previous studies, herders from the Kulchovdur community use the land in the northern part of the ABIS canal (situated in the north of the Project area)[65].

The area was divided into six parts as it is given in the map below, and the 5 respondents mentioned above were asked what parts of the Project site they use for livestock grazing (they could select more than one location). G1 and G2 areas are used by four respondents, while G3 is used by three respondents, and the one respondent was identified for areas G4 and G5. The table below gives information about Project site usage.

Table 29: Project site usage by two AoI Communities

	G1	G2	G3	G4	G5	G6
Kirlishon	80%	80%	60%	20%	20%	0%

Source: Socioeconomic survey 2023.

Note: numbers add up to more than 100% as respondents were able to select more than one answer.

[65] There has been some confusion during consultations and site visits as to where herders from Kulchovdur community grazed their livestock and initially some herders from Kulchovdur community were identified as using the Project footprint. Following extensive discussion and using maps to explain the Project location, it has now been determined that no herders from Kulchovdur community use the Project site.

Figure 68: Land use map indicating the grazing areas used during the household surveys

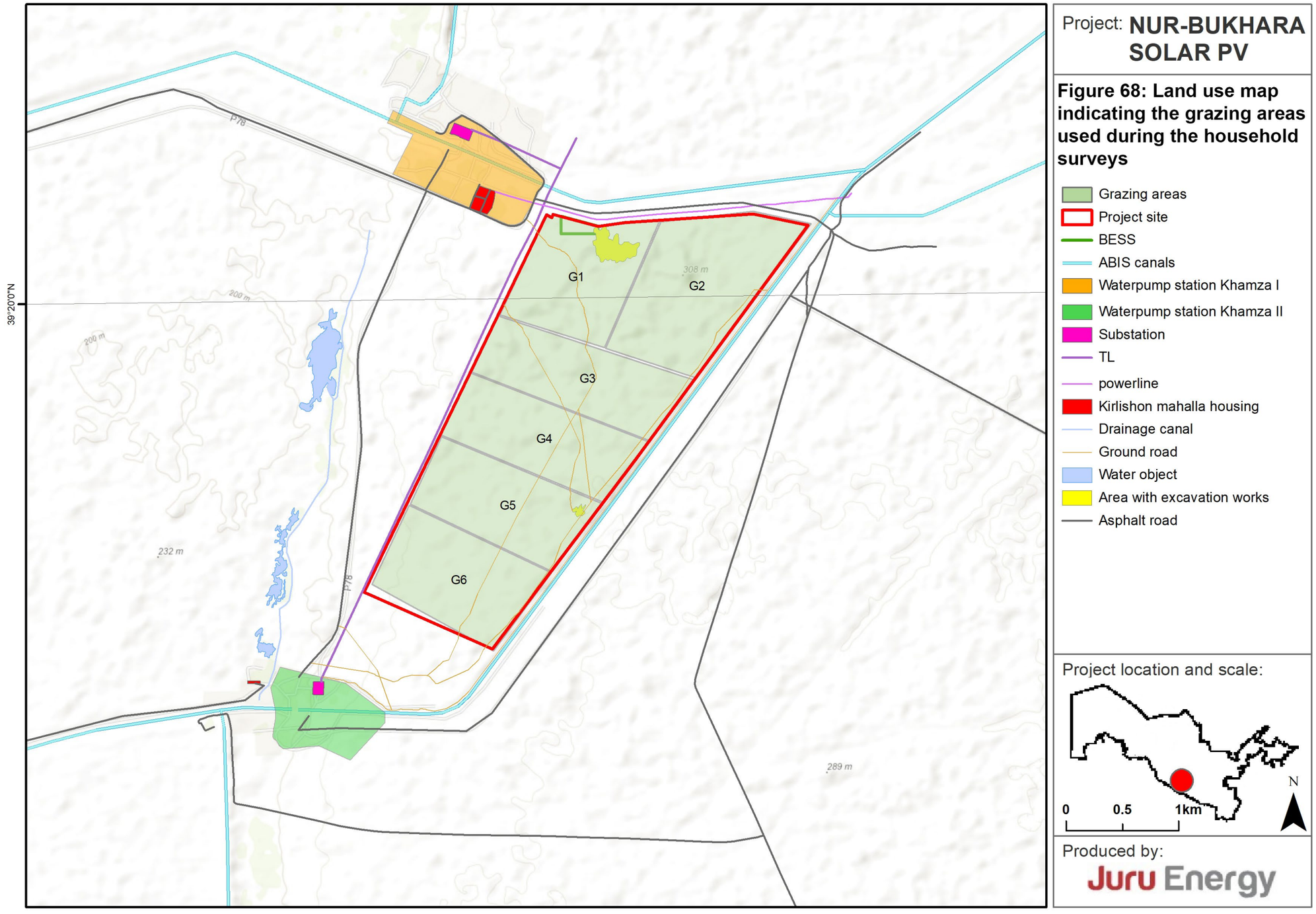
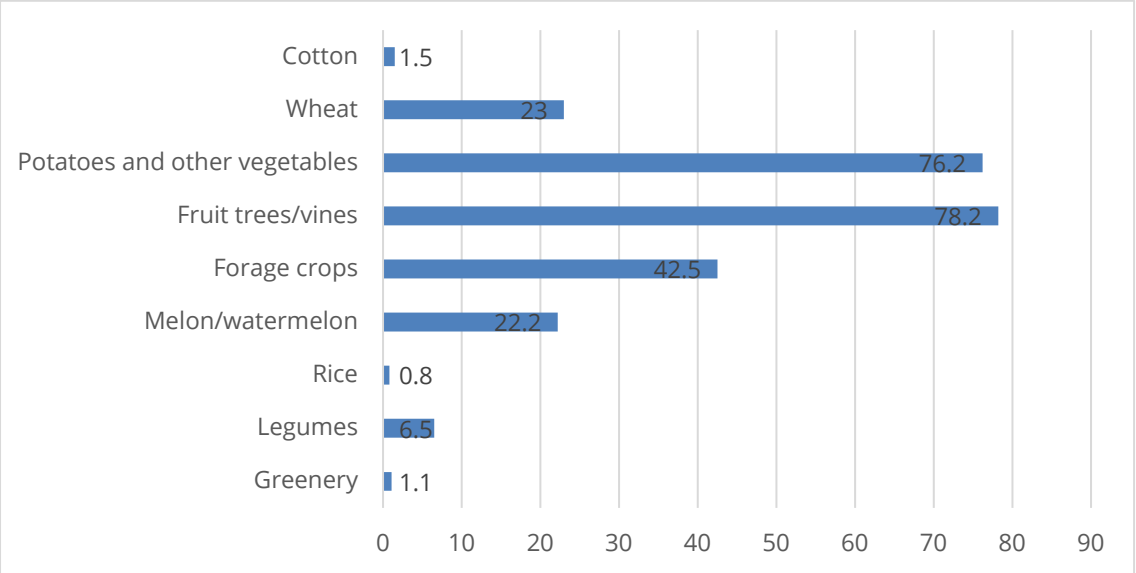


Figure 69: Type of crops grown on agricultural land plots



5.5.7 Education

The right to education is guaranteed to all citizens of the Republic of Uzbekistan under the Constitution, where it states that "[e]very person has a right to education". The State oversees education and provides free education up to secondary school. Almost 100% of the Uzbek population has at least a secondary education with women and men both at an equal ratio of 99.9%[66] .

As of 01 January 2023, the number of schools in Bukhara region and Alat district was 577 and 39 respectively[67]. In Kirlishon community there is a local school (No. 20) with 137 pupils and 20 teachers and a kindergarten (No. 11) with 46 pupils and three kindergarten teachers. In Kulchovdur community there is a local school (No. 21) with 574 pupils and 48 teachers and a kindergarten (No. 19) with 120 pupils and seven kindergarten teachers.

Many households stated that they do not send their children to pre-school, due to the fact that the kindergarten is far away. More than half of the children and students in Kulchovdur community have to walk more than 1 km to reach either kindergarten or school. Kirlishon community members are in general closer to education facilities. Table 30 and Table 31 illustrate the approximate distance that students have to travel from their home to the nearest educational facility.

Table 30: Distance to the nearest educational facility

Kindergarten					
	Up to 200 m	201-500 m	501m-1km	1km-3km	More than 3km

[66] UNDP "Human Development Report", 2016
[67] https://stat.uz/uz/matbuot-markazi/qo-mita-yangiliklar/35359-buxoro-viloyatida-nechta-maktab-bor

Kirlishon	12.2	37.8	21.6	8.1	20.3
Kulchovdur	8.0	13.3	24.5	34.0	20.2
Total	**9.2**	**20.2**	**23.7**	**26.7**	**20.2**
School					
	Up to 200 m	201-500 m	501m-1km	1km-3km	More than 3km
Kirlishon	12.2	39.2	20.3	8.1	20.3
Kulchovdur	8.0	12.8	25.0	34.0	20.2
Total	**9.2**	**20.2**	**23.7**	**26.7**	**20.2**

Source: Socioeconomic survey, 2023.

Survey respondents were asked if their nearest school is equipped with the necessary equipment. In Kulchovdur 75.7% of respondents stated that the school has everything students need, while 20.1% stated that the school is equipped with only essentials, 0.5% think that school is poorly equipped, and 3.7% found it difficult to answer. In Kirlishon 91.8% respondents think that the school is well equipped, while 8.2% believe that school is equipped with only essentials.

Survey responses show (see Table 31) that only 0.7% of household members were recorded as illiterate. However, the rate of attending higher education is also low (3.7%) in the surveyed area.

Table 31: Levels of education including all household members

Levels of education	**%**
Illiterate	0.7
Can read and write, but did not graduate from secondary school	0.4
Graduated secondary school	5.2
Graduate high school	36.5
Graduated from secondary special (college, lyceum, vocational school, technical school)	16.8
Higher education (bachelor) / postgraduate (Master's/PhD)	3.7
Schoolchildren	22.1
Preschoolers	14.7
Total	100

Source: Socioeconomic survey, 2023.

Of the total surveyed population all students (both boys and girls) eligible to attend schools/colleges/lyceums were attending these types of schools located in their communities.

5.5.8 Health

As of 2021 there were 523 health clinics in Bukhara region, while the number of clinics in Alat district was 19[68]. Overall, local communities in regions of Uzbekistan and in particular in districts have only limited number of healthcare services. Usually, villages have only one policlinic to provide first aid and general medical consultations. For specified medical services villagers have to refer to district or regional medical centres. In the AoI communities, only one clinic was observed in Kirilishon community.

Survey results found that health services are available for more than half of the survey respondents in the AOI communities - 56.4%, however, there is a significant difference between the two communities, 97.3% of respondents from Kirlishon community stated that they have access to health services, while 40.5% of respondents from Kulchovdur community have access to health services. The remainder of the respondents stated that they use the health services located in the District centre or health services located within other communities.

Respondents that stated there was no health service available in their community were asked to specify how far and where they go to for medical care. Only a small percentage (4.7%) of households had to travel more than 10 km to reach health services. The majority of households stated they travelled up to 3 km (Kirlishon community) and up to 5 km (Kulchovdur community). Table 32 provides this information.

Table 32: Distance to nearest health clinic if there is no health service available (%)

Distance	Kirlishon	Kulchovdur	Total AoI
Up to 3 km	50.0	27.6	28.0
4-5 km	0.0	39.0	38.3
6-10 km	50.0	28.6	29.0
More than 10km	0.0	4.8	4.7
Total	100.0	100.0	100.0

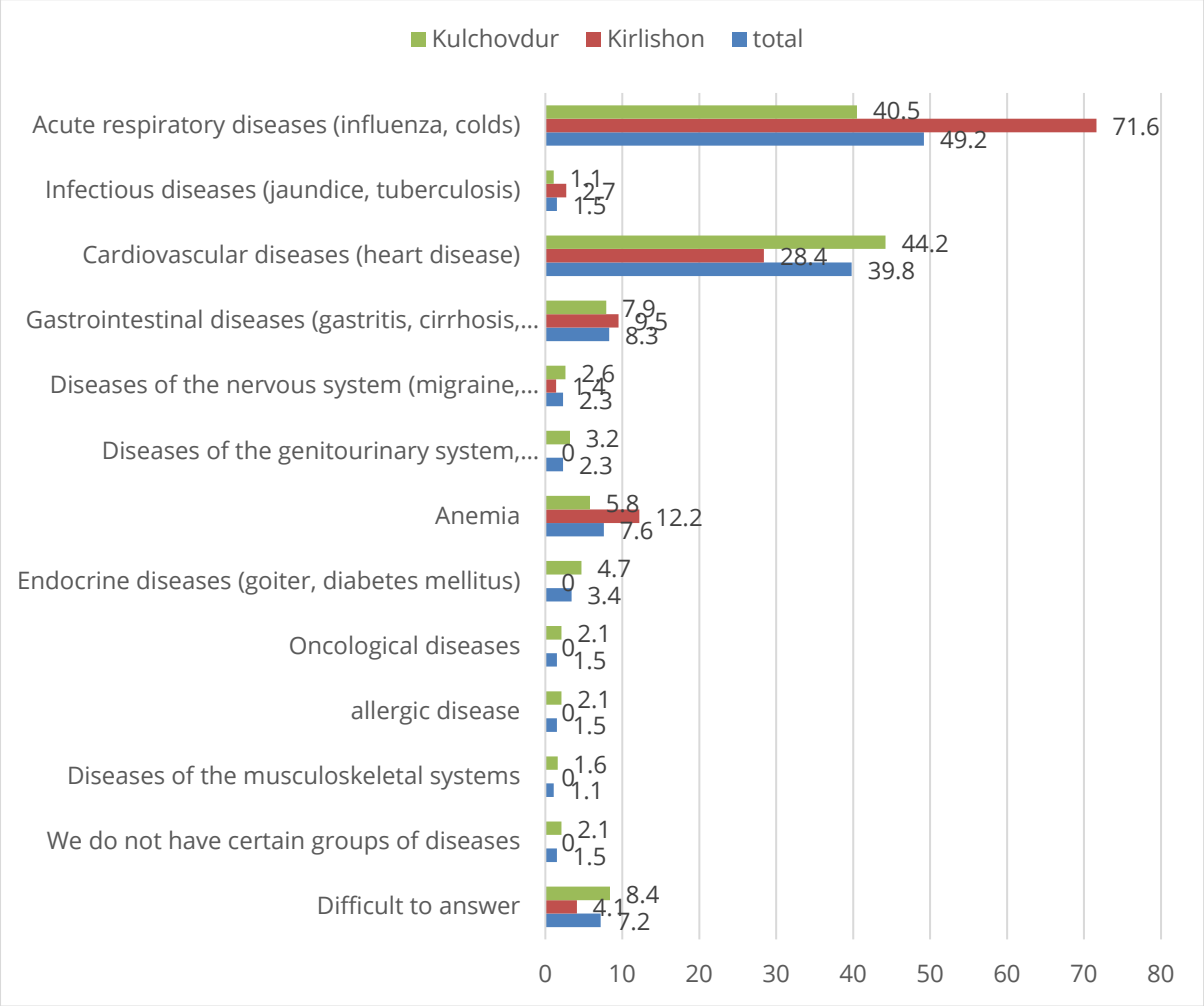
Source: Socioeconomic survey, 2023.

In addition, survey respondents were asked if they found their local health services to be well equipped, and 91.6% of all respondents stated that their local health facilities were well equipped, 0.4% were not satisfied, while 8% of respondents found the question difficult to answer. In Kirlishon 90.5% respondents were satisfied with the local health facilities, and in Kulchovdur 92.1% respondents stated that they are well equipped.

[68] https://buxstat.uz/files/297/ijtimoiy-soha/2524/3-Ambulator-poliklinikalar-soni.pdf

Figure 70 shows that survey respondents indicated the most prevalent diseases in AOI communities to be acute respiratory diseases (these include influenza and colds), cardiovascular diseases, (heart disease), gastrointestinal diseases (gastritis, cirrhosis, peptic ulcer), and anaemia.

Figure 70: Most common health concerns in the AOI communities

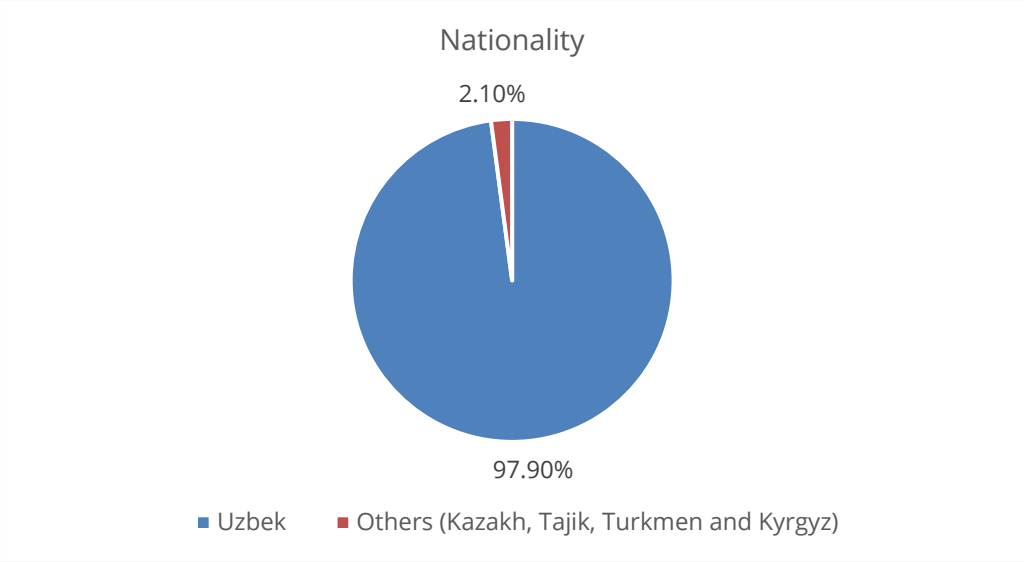


Note: The total exceeds 100% as multiple options could be selected.

5.5.9 Language and ethnicity

The ethnic composition of Alat District is predominantly Uzbek (98.3%), with the remainder of the district coming from the following ethnic groups; Turkmen (0.5%), Kazakhs (0.5%), Russians (0.1%), Tajiks (0.2%) and representatives of other nationalities (0.4%). The survey identified that the majority (97.9%) of the people in the surveyed communities are Uzbek while 2.1% are from other nations of Central Asia (Kazakhs, Tajiks, Turkmens, and Kyrgyz).

Figure 71: Nationality of surveyed communities



The survey showed that all the respondents speak the Uzbek language. Site observations found that while Uzbek is widely spoken, community members also use a mixture of words from a dialect spoken in the southern part of Uzbekistan.

There are currently two companies working in the Project AoI, with expatriate and migrant workers. There are 131 workers from the company CNTIC working on the Khamza 1 pumping station of those 34 workers all are of Chinese origin, and the remaining 97 are Uzbek. CNNC has a total of 110 workers working on the reconstruction of the Khamza 2 substation. Of those workers, 40 are of Chinese origin and 70 are Uzbek. The workers are all accommodated near to the Project site. Khanza 2 intends to complete its work at the end of 2023 and Khamza 1 will complete its work at the end of 2024, so there will be approximately one year of overlap with the Khamza 1 construction project.

The socioeconomic survey did not include questions related to religion due to sensitivity to this type of question for people in the region. However, in general, people belonging to the Uzbek, Kazakh and Kyrgyz nationalities practise Islam. Site observations as well as consultations conducted with local communities at the Scoping and ESIA stages did not reveal the presence of attributes of other religions that could cause conflict or cause individuals to be more vulnerable to Project impacts.

5.5.10 Culture, tourism, and recreation

There are no recreational facilities or cultural features of national or international importance on or near the Project site. During the consultation with local khokimiyats representatives and community members, it was revealed that none of the intangible cultural heritages listed in the UNESCO list of local importance are practiced within the Project site. Furthermore, no tangible cultural heritage objects of international or local importance were observed within the Project site.

5.5.11 Indigenous peoples

IFC PS7 defines Indigenous peoples (IPs) as a distinct social and cultural group possessing the following characteristics in varying degrees:

- Self-identification as members of a distinct indigenous social and cultural group and recognition of this identity by others;
- Collective attachment to geographically distinct habitats, ancestral territories, or areas of seasonal use or occupation, as well as to the natural resources in these areas;
- Customary cultural, economic, social, or political institutions that are distinct or separate from those of the mainstream society or culture; and
- A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.

No IPs were observed during the site visit or identified during communications with the nearest communities. IPs are not present in the AOI communities.

5.5.12 Use of the ABIS Canal

A total of 96.6% of respondents use the ABIS Canal for irrigation, 29.9% use it for household activities, 8.0% use it for drinking water, 1.9% use it for fishing and 1.5% do not use the canal at all. The total share exceeds 100%, because multiple answers could be selected. All respondents that use the canal for fishing, use the fish as a food source, and they all stated that they do not need a license to fish in the canal.

Of the 1.9% of respondents that fish (five people from both AoI communities), 40% (two people) catch around 40 kg of fish per year, while the remaining three people catch 10, 20 and 30 kgs per year respectively. Some people fish in any season, while Spring and Autumn were also mentioned as times when fishing occurred. There were six types of fish predominantly caught; silver carp, barbel, carp, and herring are caught by residents of Kirlishon community, and white amur and catfish are caught by members of Kulchovdur community.

5.5.13 Poverty and equity

According to the Asian Development Bank (ADB), as of 2020, a total of 11.5% of the population of Uzbekistan lived under the national poverty line. A total of 6.5% of the working population earned less than the $1.90 using the purchasing power parity poverty indicator as of 2021[69]. Poverty levels in Uzbekistan had been decreasing, however they have been negatively impacted by the COVID-19 pandemic. In 2020 it was determined that 1.3% of the population (approximately 448,000 people) may have fallen into poverty as a result of COVID-19[70].

The average monthly salary of a person living in Bukhara region amounted to 3,096,000 UZS (or approximately USD $273) as per statistics provided for 2022, according to Statics department of

[69] https://www.adb.org/countries/uzbekistan/poverty
[70] https://www.undp.org/press-releases/uzbekistans-health-care-system-economy-hit-hard-covid-19

Bukhara region[71]. The average monthly salary of a person living in Alat District amounted to 2,668,700 UZS (or USD $235) in 2022. The average family income reported by survey respondents was 3,979,300 UZS (or approximately USD $347) with a per capita income of 786,300 UZS (or USD $67).

While the AoI communities are considered to be relatively poor compared to the rest of the District, the District salaries and per capita household incomes cannot be directly compared, as the calculation of per capita income will include both workers and dependents.

In Uzbekistan, the minimum consumption expenditure index is used as the poverty line. According to the State Statistics Committee, the minimum consumer spending amounts to 498,000 UZS per month per person. The share of surveyed households whose income that does not exceed 498,000 UZS per capita, and thus who could be considered to be living under the national poverty line, in Kirlishon is 31.1%, while the figure for Kulchovdur community is 41.6%.

In addition to the expenditure related national poverty line, survey respondents have provided their self-determined poverty status and ownership of household items has also been reviewed to verify poverty levels. These poverty measurements are discussed further below.

Respondents to the socioeconomic survey were asked whether their income is sufficient or not. The majority of respondents indicated that their income is enough only to cover basic needs. Of all of the of respondents in the AOI communities, 18.3% stated their income was not enough to cover basic needs and 3.1% said their income is not enough to cover expenses, even for food. Community members from Kirlishon community were more likely to say that their income was enough to buy anything (26.4% as opposed to 5.8% in Kulchovdur) and community members from Kulchovdur community were more likely to say their income was not enough to cover basic needs (21.6% as opposed to 9.7%).

Table 33: Sufficiency of incomes in AOI communities

Sufficiency of incomes	Kirlishon	Kulchovdur	Total
Income is more than enough, can buy anything	26.4	5.8	11.5
Income is enough for more than just basic needs, but not enough to buy anything	31.9	30.5	30.9
Income is enough only for basic needs (food, clothing, bills)	30.6	37.4	**35.5**
Income is not enough to cover basic needs	9.7	21.6	18.3
Income is not enough even for food	1.4	3.7	3.1
No answer, refused to answer	0.0	1.1	0.8
Total	100	100	100

Source: Socioeconomic survey, 2023.

Surveyed household members in general did not own a lot of household items, which can verify the majority of households reporting that their income is not enough to buy anything. Table 34 below provides information about main household assets of the respondents. The majority of

[71] https://buxstat.uz/uploads/press-relizlar/2022/dem/Ish_haqi.pdf

households own a TV and a mobile phone (98.5% and 98.9%, respectively), the next most owned item is a refrigerator (77.7%). Only approximately one-third of household's own cars, and another one-third own motorbikes (31.9% and 34.8%, respectively), reducing the mobility of AOI households.

Table 34: Main household assets of the respondents

Main household assets	Yes	No
Car	31.9	68.1
TV	98.5	1.5
Satellite dish	6.4	93.6
Washing machine	16.3	83.7
Refrigerator	77.7	22.3
Air conditioner	15.5	84.5
Greenhouse	10.6	89.4
Personal computer	3.4	96.6
Mobile phone	98.9	1.1
Motorbike	34.8	65.2
Donkey	1.1	98.9

Source: Socioeconomic survey, 2023.

*total share exceeds 100% as multiple options could be selected

5.5.14 Human rights[72]

Uzbekistan is a member of the United Nations (UN), and has ratified all of the main international instruments of the UN relating to the protection of human rights and freedoms, including:

- UN Universal Declaration of Human Rights.
- Human Rights Council Resolution No. 30/15 on human rights and preventing and countering violent extremism.
- Convention on the Elimination of all Forms of Discrimination against Women.

In order to create the necessary organizational, legal, social, economic, spiritual, and moral foundations for the protection of human rights, in 1995-1996, two independent and effective institutions for the protection of human rights were established in Uzbekistan:

- The Human Rights Commissioner (Ombudsman) of the Oliy Majlis of the Republic of Uzbekistan; and
- The National Centre for Human Rights.

There continue to be some areas where Uzbekistan could improve in relation to human rights. Although Uzbekistan prohibits violence against women and girls, there is no reliable data on

[72] The Nur Bukhara Human rights impact (HRIA) assessment provides more details on this topic.

domestic violence in Uzbekistan, where many victims remain silent for fear of bringing shame to their families[73]. Gender based violence and harassment (GBVH) is discussed further below.

A Human Rights Impact Assessment has been prepared for this project and is included in Volume III: ESIA Technical Appendix.

5.5.15 Vulnerable groups

According to the survey results, vulnerable groups identified in the AOI communities mainly consist of low-income families, people with disabilities as well as the unemployed, which is similar to data obtained from the local community administration.

Approximately 10 vulnerable people were identified during consultations with the Kirlishon community leader. A total of potentially 70 vulnerable people were identified during consultations with the Kulchovdur community leader. Vulnerable groups were defined as youth, unemployed and disabled community members.

Among the surveyed households, the number of disabled people in the total number of household members is 35 (2.6%). Of the 35 disabled people, 30 (85.7%) of them have physical disability, while 5 people (14.3%) are mentally disabled.

Applicability to receive allowances is also a measure of vulnerability. Respondents were asked if they receive a monthly low-income allowance and 4.1% of respondents in Kirlishon and 2.6% of respondents in Kulchovdur said yes, while 38.4% in Kirlishon and 22.1% in Kulchovdur indicated that they should receive an allowance, but it is not provided. The remainder of respondents do not receive an allowance.

When respondents were asked whether they receive monthly child allowances from the mahalla, 26.0% in Kirlishon confirmed that they received a child allowance, while 21.9% stated that they should receive an allowance, but none is provided. The remaining 34.2% do not meet the criteria to receive a monthly child allowance, and 17.8% have no children under 16. In Kulchovdur, 28.9% receive a monthly child allowance, while 12.6% should receive but are not provided with one. The remaining 44.2% stated that they do not meet the criteria to receive a monthly child allowance, and 17.8% have no children under 16.

5.5.16 Gender and gender based violence

Women in Uzbekistan make up slightly less than half of the population 17,896,300 (49.7%) women and 18,128,600 (50.3%) men[74]. At the beginning of 2023, in Bukhara region, males were slightly more than females amounting to 1,007,300 (50.1%) versus 1,002,400 (49.9%). For the same period the population of the Alat District was 51,500 (50.1%) male and 51300 (49.9%) female[75]. The gender distribution of the AoI communities, based on survey information showed it is consistent with the District statistics, with slightly more men (50.1%) than women (49.9%). This shows that there is no

[73] ADB,2018.

[74] https://api.stat.uz/api/v1.0/data/doimiy-aholi-soni-erkaklar?lang=uz&format=pdf

[75] https://www.buxstat.uz/uz/?preview=1&option=com_dropfiles&format=&task=frontfile.download&catid=286&id=3322&Itemid=1000000000000

gender imbalance in the communities, and suggests that people, in general, stay in the community and to not migrate for work.

In recent years participation of women in the labour market has been increasing significantly. In 2020 the female labour force participation rate was 40% in Uzbekistan[76]. Also, 32.7% of seats in national parliament were held by women in 2021 in Uzbekistan[77]. Results from the socioeconomic survey show that 23% of women in the Project area are home makers, 14.7% work on a household plot (significantly more than men at 4.2%) and 24% of the women in the Project area are pensioners (other responses included employed on a farm, entrepreneur, and employed in the government, among others). Of the surveyed households 7.4% of women said they were unemployed in active search of a job, a similar number to men in the Project area (8.4%).

Survey results reveals that women in the Project area are expected to perform domestic chores like cooking and washing. While the men are more involved in going to the market, the purchase of food and non-food items.

As mentioned in the education section, education is a right for all children in Uzbekistan. Girls have a similar education rate to boys, 97.1% of girls and 97.9% of boy's complete lower secondary school in Uzbekistan as of 2020 data.

Uzbekistan experienced an increase in domestic violence as a result of the outbreak of COVID-19. Alongside the economic hardships which have resulted in income and job losses in many households, there has been an increase in the rates of physical, verbal, emotional, financial, and sexual abuse against women and girls. Domestic violence is a form of gender-based violence and harassment (GBVH).

There is a lack of official statistics on GBVH in Uzbekistan, and a cultural hesitation to discuss the topic. According to the Ministry of Internal Affairs, local law enforcement in Uzbekistan issued more than 8,430 protection orders to ensure the security of domestic violence victims between January to October 2020. Of these, 4,330 experienced physical abuse, while around 3,200 suffered emotional abuse[78]. The number of unreported cases is expected to be much higher.

The NGO Oydin Nur the 'Regional Center for Social Protection of the Family' (the only NGO currently active in the Project AoI), reports that in the Bukhara Region is has provided 716 women with children with temporary shelter (2007-2020 – approximately 55 per year). It also states that it has provided 5,830 women with psychological counselling (2000-2020 – approximately 291 per year), 2,874 women with free legal advice (2004-2020 – approximately 197 per year), and has received 10,752 appeals to their helpline (2007-2020 – approximately 827 per year). This gives a general indication of the prevalence of GBVH in Bukhara region.

Community members were asked about GBVH in the Project AoI, but did not feel comfortable to discuss the issue, during focus group meetings.

[76] https://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS?locations=UZ
[77] https://genderdata.worldbank.org/countries/uzbekistan/
[78] World Bank, 2021

If GBVH occurs, communities can report it to several authorities in charge of the receipt and support of grievances related to GBVH. These include:

1. The nearest office/department of the Ministry of Internal Affairs. Alternatively, GBVH cases can be reported through a phone call to the police (on number 102).
2. The local makhalla office.
3. Dialling 1169 for the helpline of the Republican Rehabilitation and Adaptation Centre for Women in Critical Situations.
4. Dialling 1259 for the helpline of the Ministry of Internal Affairs for victims of harassment and violence.
5. Dialling 1146 for the helpline of Ministry for the Support of the Makhalla and the Older Generation.
6. Apply to the court.

The above helplines operate 24/7 and can also accept confidential applications. Information received through the telephone network is restricted for disclosure, except in the cases prescribed by law.

Based on the Resolution of Cabinet of Ministries No. 3 dated 4.01.2020 "On further improvement of measures to protect women from violence and harassment" victims of harassment and violence have the following rights:

- Appealing harassment and violence or the threat thereof to the relevant authorities and organisations or to a court.
- Receiving free legal advice, economic, social, psychological, medical and other assistance at special centres through a toll-free telephone number (1146).
- Applying to the court for property and personal damages for the victim of harassment and violence.
- The victim of harassment and violence is exempt from paying state fees when applying to the court for compensation for material and personal damage.

5.6 Biodiversity

5.6.1 Introduction

The Project is located at the southwestern extreme of the Kyzylkum desert region, within a sub-region called the Sundukli Sands. This is generally a very dry region characterised by low density, height, diversity, and productivity of plant life, and similarly low density and diversity of animal life, though many of the species are highly adapted and specialized to survive in desert climates, and the flora and fauna include a number of sensitive species with relatively narrow ecological and geographic ranges. The region is generally flat and contains several small, isolated mountain ranges or rocky massifs, though the Project site is not located in close proximity to any mountains or rocky massifs. The Project site is generally flat and covered with native psammophilous brushy

desert vegetation typical of fixed sands, sandy deserts of the Sundukli Sands region, with dominant shrubs including various species of *Calligonum*, Saxaul (*Haloxylon ammodendron*), and Saltworts (*Xylosalsola* spp.).

Although it is a very dry region, the Kyzylkum Desert contains several isolated lakes and other water bodies located in large topographic depressions, some of which are saline due to substantial evaporation. The Project is located within the Bukhara region, which is an area that contains a network of waterbodies, including saline and freshwater lakes. The Project is located roughly 35 km northeast of the Amu Darya riparian corridor, a major river system that flows northwest toward the Aral Sea. It is of great importance as a water source, both for the agricultural activity and human settlements of the region and for the region's biodiversity. A network of irrigation canals, called the Amu-Bukhara Irrigation System (ABIS canals) has been created to support agricultural activity in the Project region. One ABIS canal runs along the entire eastern border of the Project site; another canal runs E-W just north of the northern border of the Project site; and another canal runs westward just south of the southern border of the Project site. Roughly one kilometre to the west of the Project site, a narrow corridor of small saline ponds and ephemeral water drainage channels runs along a slight depression, in a N-S orientation. These canals and other water features support strips of lusher riparian vegetation (discussed in more detail below), and support aquatic and riparian flora and wildlife.

As is the case for most of the Kyzylkum desert, the Project site has historically been used by the region's human communities for low density domestic livestock grazing activity, with vegetation types and habitats in a largely natural condition, but reflecting anthropogenic pressures from livestock grazing (e.g., reduction of vegetation cover), as well as other pressures, such as hunting and disturbance.

The biodiversity baseline characterization for the Project has been developed by a team of national and international biodiversity experts, and is based on a comprehensive desktop review, combined with the results of baseline biodiversity studies. The desktop review served as a basis to conduct an initial screening for Critical Habitat (CH) features (IFC PS6 and EBRD PR6) and Priority Biodiversity Features (PBF, EBRD PR6) and to scope a set of biodiversity baseline surveys.

The biodiversity baseline section of this ESIA integrates desktop and field studies of the biodiversity of the Project's ecological area of influence (equivalent to the Ecologically Appropriate Area of Analysis, or EAAA), and is intended to characterize the baseline condition of the Project area, with a focus on the biodiversity elements that have been identified either as CH features, PBF, or Natural Habitat (NH, per IFC PS6) for the Project. This information is supported by the full biodiversity baseline study reports, and the CH Assessment (CHA) report, included in ESIA Volume III, Technical Appendix.

5.6.2 Protected areas and internationally recognized Key Biodiversity Areas

Five areas with national protected area (PA) status and/or internationally recognized important biodiversity value (Key Biodiversity Areas[79]) were identified in the 50 km AOI (Table 35 and Figure 72)[80]. The closest of these to the Project area, Lake Dengizkul, is classified as a state nature reserve, an Important Bird Area (IBA, a type of KBA, per IFC PS6), and it is protected under the Ramsar Convention (another type of KBA, per IFC PS6). This large lake is known as an important wintering area for the IUCN Endangered White-headed Duck (*Oxyura leucocphala*), and also supports important concentrations of additional wintering and breeding water birds, as well as other biodiversity associated with aquatic habitats or the marsh habitat that lines portions of the Lake. The Project is considered to have negligible potential to impact the biodiversity of Lake Dengizkul at any stage of the Project's life cycle, as the Lake is located 8 km from the Project site at its closest point, and as the Project, itself, is located entirely within upland habitats. The Project is located even further from the other four PA or KBA within the 50 km radius, and these areas are also considered to have negligible potential to be impacted by the Project.

[79] Key Biodiversity Areas (KBAs) are the most important places in the world for species and their habitats. Faced with a global environmental crisis we need to focus our collective efforts on conserving the places that matter most. The KBA Programme supports the identification, mapping, monitoring and conservation of KBAs to help safeguard the most critical sites for nature on our planet – from rainforests to reefs, mountains to marshes, deserts to grasslands and to the deepest parts of the oceans (www. https://www.keybiodiversityareas.org/).

[80] Integrated Biodiversity Assessment Tool (IBAT)

Figure 72: Legally protected areas and internationally recognized Key Biodiversity Areas (KBA) within 50 km of the Nur-Bukhara Solar Project area.

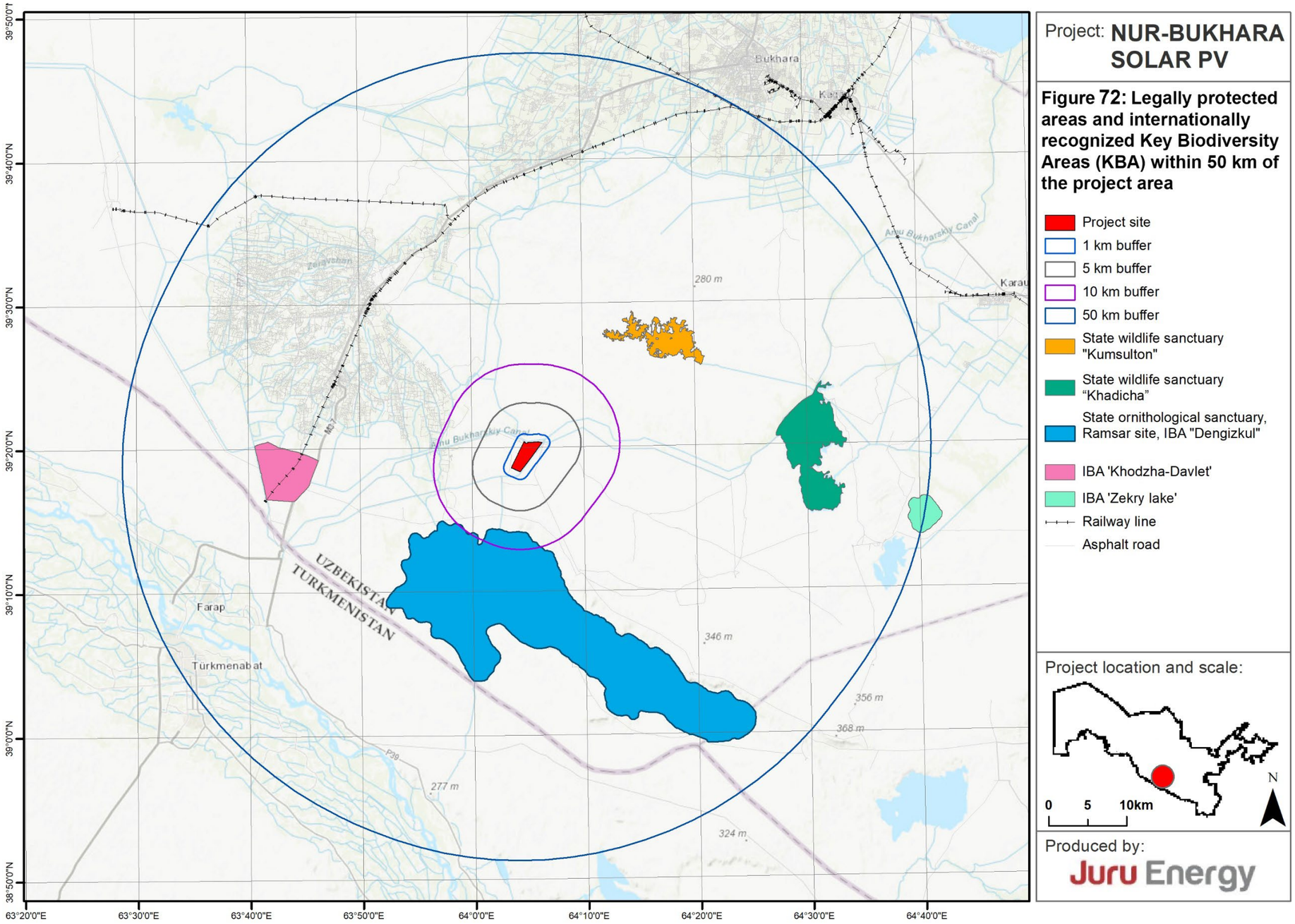


Table 35: Legally protected areas and internationally recognized Key Biodiversity Areas (KBA) within 50 km of the Nur-Bukhara Solar Project area.

Name	National site (IUCN Management Category)	International site	Area (ha)	Distance to project site	Organisation	Purpose
Lake Dengizkul	Ornithological Nature Reserve[81] (IV Category)	Ramsar site N1108[82], IBA UZ021[83]	31,300	8 km	MNR	Ornithological Nature Reserve Protected Areas
Kumsultan	State wildlife sanctuary (IV Category)[84]	-	4,900	16.5 km	Bukhara regional Khokimiyat	Terrestrial and Inland Waters Protected Areas
Khadicha	State wildlife sanctuary (IV Category)[85]	-	11,300	30 km	Bukhara regional Khokimiyat	Terrestrial and Inland Waters Protected Areas
Khodzha-Davlet	-	IBA[86]	4,242	25 km	--	Bird conservation
Zekry	-	IBA[87]	1,555	48 km	-	Bird conservation

5.6.3 Flora and habitats

5.6.3.1 Methods

The botanical baseline data collection was developed using a combination of desk-based review of secondary information sources and primary data gathering through a field survey effort conducted within the Project area. Desktop research included a comprehensive review of available technical literature on the flora of Uzbekistan, as well as review of publicly available databases including, the IUCN Red List of Threatened Species. The botanical field surveys of the site conducted for the scoping report[88] provided a key source of information to evaluate rare plants, as this study included botanical field surveys conducted at the Project site by national botanical

[81] UNEP-WCMC (2023). Protected Area Profile for Lake Dengizkul from the World Database on Protected Areas, March 2023. Available at: www.protectedplanet.net
[82] https://rsis.ramsar.org/ris/1108
[83] BirdLife International (2023) Important Bird Areas factsheet: Dengizkul Lake. Downloaded from http://www.birdlife.org on 19/03/2023. http://datazone.birdlife.org/site/factsheet/dengizkul-lake-iba-uzbekistan
[84] UNEP-WCMC (2023). Protected Area Profile for Kumsultan State Wildlife Sanctuary from the World Database on Protected Areas, March 2023. Available at: www.protectedplanet.net
[85] UNEP-WCMC (2023). Protected Area Profile for Khadicha State Wildlife Sanctuary from the World Database on Protected Areas, March 2023. Available at: www.protectedplanet.net
[86] BirdLife International (2023) Important Bird Areas factsheet: Khodzha-Davlet. Downloaded from http://www.birdlife.org on 19/03/2023. http://datazone.birdlife.org/site/factsheet/khodzha-davlet-iba-uzbekistan
[87] BirdLife International (2023) Important Bird Areas factsheet: Zekry Lake. Downloaded from http://www.birdlife.org on 19/03/2023. http://datazone.birdlife.org/site/factsheet/zekry-lake-iba-uzbekistan
[84] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

expert, Natalya Beshko, during the very restricted seasonal window (late May – early June) when *Calligonum* spp. can be confidently identified to the species level.

The same botanical expert also conducted additional botanical and habitat mapping baseline surveys at the Project site on 08 to 09 April and June 17 2023, to sample and map vegetation, and to characterize the floristic composition and spatial patterns of plant communities in the Project area and immediate surroundings. The structure of vegetation communities was characterized by sampling a series of 50x50 m geobotanical sample plots (SP) chosen in areas with homogeneous vegetation, representative for each habitat or vegetation type present within the study area. Information gathered during these field surveys was used to develop GIS-based maps of habitat/vegetation types present in the Project area and immediate surroundings. Species abundance was determined using the Braun-Blanquet cover-abundance scale, and a complete list of plant species documented in the Project area was produced. A full description of the Botanical baseline survey methods, and sampling effort is presented in Volume III, Technical Appendix.

5.6.3.2 Habitats

The Project area is primarily covered with brushy desert habitat typical of the Sundukli Sands region of the southern Kyzylkum Desert (Figure 73). The only other habitat type within the Project area, itself, are heavily disturbed areas where two small quarries are present (Figure 73). In the immediate surroundings of the Project area, there is a small village, a few small crop fields, and a few other small patches of other Modified Habitats (per IFC PS6) (Figure 73). The eastern boundary of the Project area is bordered by one of the ABIS canals, and other ABIS canals parallel the northern and southern borders of the Project area, set back roughly 100 m (northern) and 500 m (southern) from the Project area border. Roughly 1 km to the west of the Project area is a small corridor of primarily ephemeral, and highly saline drainage channel and ponds, running along a depression (Figure 73).

The ABIS canals are lined with narrow strips of riparian vegetation formed by Turanga (Populus euphratica, P. pruinosa.), and also including Willow (Salix wilhelmsiana), Ravenna Grass (Tripidium ravennae) and Common Reed (Phragmites australis) (Figure 77). The saline ponds to the west of the Project site include a small drainage channel (

Figure 78) as well as 2-3 small ponds. Two of these ponds are shallow and probably ephemeral (Figure 79), while one is slightly larger and deeper, and may hold water permanently, or for longer periods than the others (Figure 80). Vegetation around these drainage channels is represented by shrubs of *Tamarix* spp. (local. 'yolgun'), Camel thorn (*Alhagi* spp.), and saltworts (*Xylosalsola* spp.).

The upland desert shrubland vegetation that covers almost all of the Project area is dominated by native psammophilous shrubs of the region, including *Calligonum* spp., Saxaul (*Haloxylon ammodendron*), and saltworts (*Xylosalsola* spp.) (Figures 72-74). In the northern, western, and central parts of the Project area, the dominant shrubs are *Xylosalsola arbuscula*, *X. richtery,* and

Calligonum spp. In the eastern and southern portions of the Project area, the dominant shrubs are *Haloxylon ammodendron,* and *Haloxylon persicum*. Throughout the area, the herbaceous cover is primarily composed of desert sedge (*Carex physodes*). The upland desert vegetation that covers most of the Project area contains a viable assemblage of species of largely native origin, and human activity has not essentially modified the area's primary ecological functions and species composition. Therefore, it is classified as Natural Habitat, per IFC PS6.

Figure 73: Habitat map of the Nur-Bukhara Solar Project area and immediate surroundings

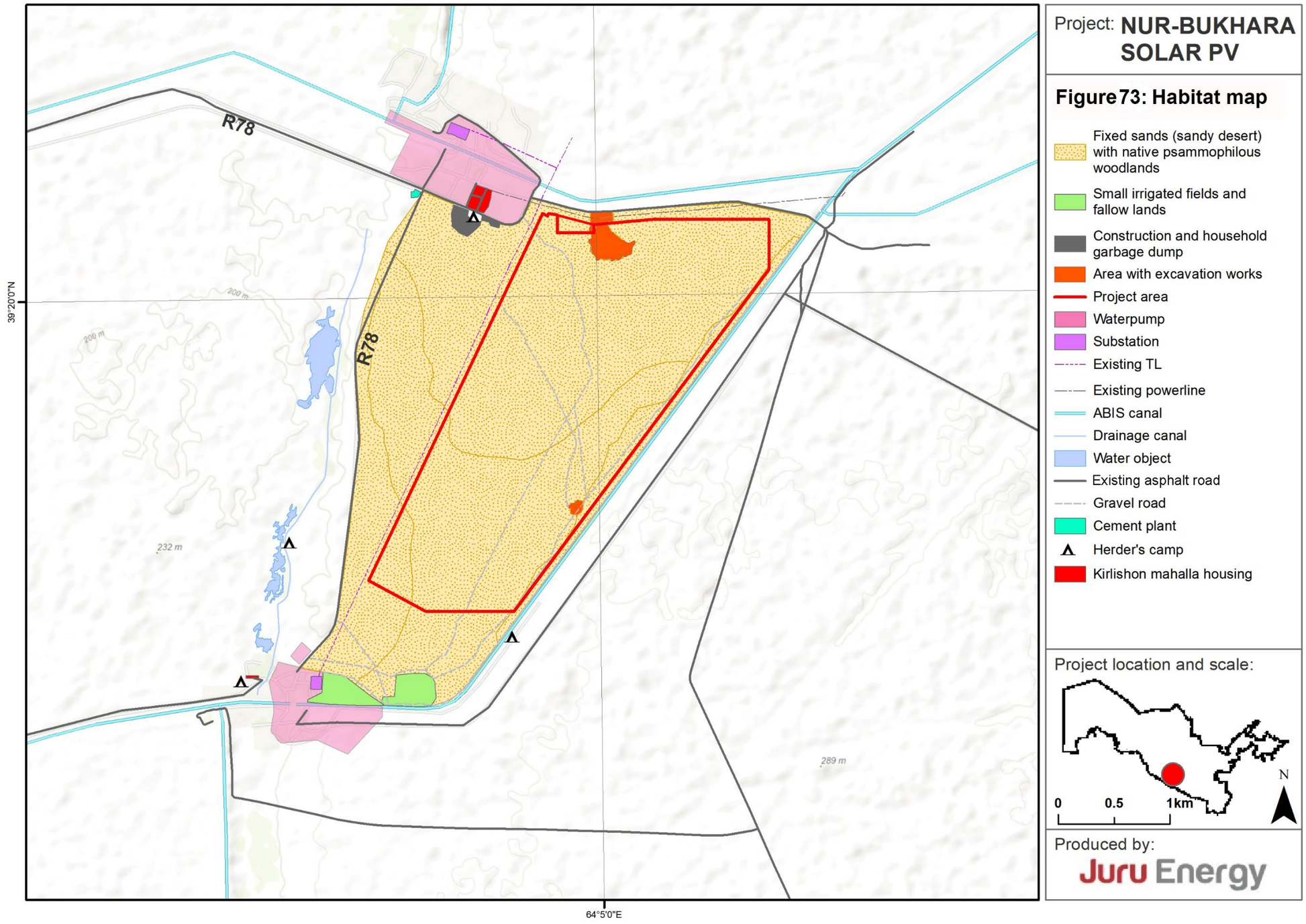


Figure 74: Representative vegetation of the project area - sandy desert with psammophilous shrubs

Figure 75: Saxaul shrubs are numerous in eastern and southern part of project area

Figure 76: Calligonum sp. are numerous on the project site. This genus includes both widespread and non-redlisted species, as well as several rare and redlisted species that occur on the Project site. These species can only

be identified during a small period in late May-early June, when seeds are ripe, but have not yet fallen from the plants (N. Beshko, pers. comm.)

Figure 77: Amu-Bukhara Irrigation System (ABIS) canal with a narrow strip of short riparian vegetation dominated by Turanga (Populus sp.), running parallel to the border of the Nur-Bukhara Project area.

Figure 78: A smaller drainage channel of the ABIS canal near the Nur-Bukhara Project area.

Figure 79: Saline ephemeral wetland habitat with Elgun Tamarix sp. roughly 1 km west of the Nur-Bukhara Solar Project site.

Figure 80: Saline Pond with drainage ponds/riparian vegetation roughly 1 km west of the Nur-Bukhara Solar Project site

5.6.3.3 Sensitive Plants

A total of 72 plant species were documented at the Project site and immediate surroundings during the spring, 2023 botanical baseline surveys (TA09). None of these species have a redlist status of Vulnerable or higher on either the global IUCN redlist, or the national plant red data book of Uzbekistan. One species of riparian tree (*Populus pruinosa*, IUCN NT, UzRDB NT) was the only species documented at the site with any elevated status on either the national or international redlist.

However, the botanical surveys conducted in May and June of 2021 for the scoping study[89] documented three species of shrub in the genus, *Calligonum*, with elevated status on both national and international redlists. These species are addressed individually below. We note that the Project area contains a mix of both common (non-redlisted) and rarer (redlisted) species of *Calligonum*, and that these species can only be confidently identified to the species level during a brief period in late May and early June, when the seeds have ripened, but have not yet fallen off of the parent plants (N. Beshko, pers. comm.).

5.6.3.4 *Calligonum matteianum*

This species is classified as EN by IUCN, and Category 2 – Rare, on the national plant redlist of Uzbekistan (Figure 81). On the basis of the CHA, it has been classified as a PBF for the Project (Volume III: ESIA - Critical Habitat Assessment Report). It occurs in sandy deserts of Uzbekistan and Turkmenistan and is known to occur in the deserts surrounding Lake Dengizkul. During field

[89] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

surveys conducted for the scoping report[90], several specimens were found in the northern part of Project site, in surroundings of the quarry, and in the western part, between the pump station and the small village of Hamza. No additional information on the abundance or distribution of this species at the site could be collected during the June, 2023 surveys, as the *Calligonum* individuals at the site did not flower or bear fruit in 2023 due to severe drought conditions, precluding species-level identification of *Calligonum spp*. at the site.

Figure 81: Calligonum matteianum, showing closeup of mature seeds at right (Photos: N. Beshko)

5.6.3.5 *Calligonum mole*

This species is classified as EN by IUCN EN, and Category 2 – Rare on the national plant redlist of Uzbekistan (Figure 82). On the basis of the CHA, it has been classified as a PBF for the Project (Volume III: ESIA - Critical Habitat Assessment Report). It is known to occur within deserts of Uzbekistan, Turkmenistan, Tajikistan, and Iran. During field surveys conducted for the scoping report[91], several specimens were found in the northern part of Project site, in the surroundings of the quarry. No additional information on the abundance or distribution of this species at the site could be collected during the June, 2023 surveys, as the *Calligonum* individuals at the site did not flower or bear fruit in 2023 due to severe drought conditions, precluding species-level identification of *Calligonum* spp. at the site.

[90] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.
[91] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

Figure 82: Calligonum molle, showing closeup of mature seeds at right (Photos: N. Beshko)


5.6.3.6 *Calligonum paletzkianum*

This species, classified as VU by IUCN and Category 3 – Vulnerable on the Uzbekistan plant redlist (Figure 83). On the basis of the CHA, it has been classified as a PBF for the Project (Volume III: ESIA - Critical Habitat Assessment Report). This species is known to occur in desert regions of Uzbekistan and Turkmenistan. Within Uzbekistan, it is only known from areas surrounding Lake Dengizkul. During field surveys conducted for the TYPSA E&S Scoping report, several specimens were found in the northern part of Project site, in surroundings of the quarry. No additional information on the abundance or distribution of this species at the site could be collected during the June, 2023 surveys, as the *Calligonum* individuals at the site did not flower or bear fruit in 2023 due to severe drought conditions, precluding species-level identification of *Calligonum* spp. at the site.

Figure 83: Calligonum paletzkianum, showing closeup of mature seeds at right (Photos: N. Beshko)


5.6.4 Ornithofauna

5.6.4.1 Methods

The avifaunal baseline characterization was developed using a combination of desk-based review of secondary information sources and primary data gathering through an intensive bird baseline survey effort conducted within the Project area. Desktop research included a comprehensive review of available technical literature on the birds of Uzbekistan, as well as review of publicly

available databases including, but not limited to the IUCN Red List of Threatened Species, eBird database, and BirdLife International data zone. Although a variety of secondary sources contain information regarding the avifauna of larger regions encompassing the site, or certain areas within the larger Project regions, there are no previously published studies of the avifauna of the Project site.

Primary bird survey data from the Project site included the results of field studies conducted in May-July 2021 for the scoping report[92], as well as a set of complementary bird baseline surveys for this ESIA designed by international and national biodiversity experts and conducted by Uzbek ornithologists in March-April 2023. The methodology used in the TYPSA field surveys included a total of 18 hours of Vantage Point surveys conducted over four visits at a single vantage point[93], plus transect surveys conducted during each of the four visits to the site conducted by ornithologists between 08 May and 04 July 2021. The bird survey methodologies implemented for this ESIA included a preliminary walkover survey on 02 March 2023, 30-minute Houbara Bustard surveys conducted during the first three hours after sunrise at five points spread across the site on 11 April 2023, and waterbird surveys conducted at three points with views onto the small ponds and wetlands located roughly 1 km to the west of the site on 15 April 2023. A full description of the bird baseline survey methods, and sampling effort is presented in Volume III Technical Appendix.

5.6.4.2 Sensitive Bird Species

The bird baseline surveys conducted at the site resulted in observations of 36 bird species, listed in Table 36. One of these species (Steppe Eagle, *Aquila nipalensis*) has elevated global conservation status on the IUCN redlist, and the Steppe Eagle plus two other species (Mute Swan, *Cygnus olor*; Pin-tailed Sandgrouse, *Pterocles alchata*) were the only three species with elevated national conservation status observed at the site during the baseline field surveys (Table 36).

Table 36: All bird species observed at the Nur-Bukhara Project site and vicinity during baseline surveys conducted during the scoping study (May-July 2021[94]) and Juru (March-April 2023). IUCN status is LC (Least Concern), and national status is unlisted, unless otherwise noted.

Scientific name	Common name	IUCN status	Uzbekistan Red Data Book (2019)	Total number observed
Cygnus olor	Mute Swan		**NT**	5
Anas platyrhynchos	Mallard			3
Columba livia	Rock Pigeon			5
Columba oenas	Stock Dove			6
Pterocles alchata	Pin-tailed Sandgrouse		**VU**	1
Pterocles orientalis	Black-bellied Sandgrouse			18
Apus apus	Common Swift			5

[92] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

[93] Scottish Natural Heritage. (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. V2, March 2017.

[94] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

Scientific name	Common name	IUCN status	Uzbekistan Red Data Book (2019)	Total number observed
Himantopus himantopus	Black-winged Stilt			5
Vanellus leucurus	White-tailed Lapwing			4
Charadrius dubius	Little Ringed Plover			3
Chroicocephalus genei	Slender-billed Gull			2
Larus cachinnans	Caspian Gull			11
Sternula albifrons	Little Tern			6
Gelochelidon nilotica	Gull-billed Tern			2
Sterna hirundo	Common Tern			3
Phalacrocorax carbo	Great Cormorant			71
Ardea cinerea	Gray Heron			4
Aquila nipalensis	Steppe Eagle	**EN**	**VU**	2
Circus aeruginosus	Eurasian Marsh-Harrier			11
Circus cyaneus	Hen Harrier			1
Accipiter badius	Shikra			1
Merops persicus	Blue-cheeked Bee-eater			51
Lanius excubitor	Great Gray Shrike			3
Pica pica	Eurasian Magpie			6
Corvus monedula	Eurasian Jackdaw			7
Galerida cristata	Crested Lark			26+
Hirundo rustica	Barn Swallow			30
Scotocerca inquieta	Scrub Warbler			7
Curruca curruca	Lesser Whitethroat			11
Curruca nana	Asian Desert Warbler			2
Acridotheres tristis	Common Myna			2
Cercotrichas galactotes	Rufous-tailed Scrub-Robin			1
Luscinia svecica	Bluethroat			2
Passer domesticus	House Sparrow (Indian Sparrow)			22
Motacilla flava	Western Yellow Wagtail			6
Motacilla alba	White Wagtail (include “Masked” Wagtail)			8

Noting the seasonal limitations of the ornithological field surveys (02 March to 04 July 2023), the ornithological baseline characterization supplemented the evidence from site-specific field surveys with desktop-level review of available literature and publicly available databases, in order to characterize the avifauna potentially occurring at the site throughout the full spectrum of seasonal variation at the site. The desktop review included review of the scoping report[95], an IBAT report generated for the Project area[96], and comprehensive review of eBird, IUCN, and BirdLife International databases. This resulted in a broader list of 30 bird species with elevated conservation status on either the national or international (IUCN) redlists with potential to occur at the site, and all of these species were assessed against CH (IFC and EBRD) and PBF (EBRD) criteria in the CHA (Volume III: ESIA - Critical Habitat Assessment Report).

[95] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.
[96] IBAT PS6 and ESS6 Report. Generated under license 1781-26131 from the Integrated Biodiversity Assessment Tool on 17 January 2022. www.ibat-alliance.org

This assessment produced a list of nine bird species classified as PBF for the Project, per EBRD PR6, presented in Table 37, and no bird species triggering a Critical Habitat determination for the Project, per IFC PS6 or EBRD PR6. Each of the bird species identified as a PBF for the Project is addressed in more detail in a separate subsection below.

Table 37: Bird species classified as Priority Biodiversity Features (PBF) for the Nur-Bukhara Solar Project

Scientific name	Common name	IUCN status	Uzbekistan Red Data Book (2019)	Observed at site?
Oxyura leucocephala	White-headed Duck	**EN**	**EN**	no
Marmaronetta angustirostris	Marbled Teal	**NT**	**EN**	no
Chlamydotis macqueenii	Macqueen's Bustard (Asian Houbara)	**VU**	**VU**	no
Vanellus gregarius	Sociable Lapwing	**CR**	**VU**	no
Pelecanus crispus	Dalmatian Pelican	**NT**	**EN**	no
Neophron percnopterus	Egyptian Vulture	**EN**	**VU**	no
Haliaeetus leucoryphus	Pallas's Fish-Eagle	**EN**	**EN**	no
Aquila nipalensis	Steppe Eagle	**EN**	**VU**	yes
Falco cherrug	Saker Falcon	**EN**	**EN**	no

5.6.4.3 White-headed Duck *Oxyura leucocephala*

White-headed Duck breeds on small to large freshwater or brackish lakes and wetlands throughout southern Europe and south-central Asia. The Asian breeding population is migratory and overwinters sometimes in large aggregations in large deep-water lakes. In the Project region, Lake Dengizkul, 8 km to the south of the Project site, is known as an important wintering area for this species. Additionally, it was hypothesized that this species could possibly breed at some of the small ponds located roughly 1 km to the west of the Project site, as White-headed Ducks are known to breed within wetland complexes within the Bukhara region. This species was not recorded during surveys of the small wetland complex located roughly 1 km to the west of the Project area in spring 2023 (See Technical Appendix 9).

5.6.4.4 Marbled Teal *Marmaronetta angustirostris*

Marbled Teal breeds in small ponds and wetlands throughout southern Europe and south-central Asia. This species is considered to be partially migratory and nomadic and may aggregate in large concentrations during the non-breeding season. In the Project region, Marbled Teal are known to breed opportunistically in small wetlands in the Bukhara Region, and it was, therefore, hypothesized that this species could possibly breed at some of the small ponds located roughly 1 km to the west of the Project site. This species was not recorded during surveys of the small wetland complex located roughly 1 km to the west of the Project area in spring 2023 (See Technical Appendix 9).

5.6.4.5 Macqueen's Bustard *Chlamydotis macqueenii*

Macqueen's Bustard, also known as the Asian Houbara Bustard, or Asian Houbara is a large, terrestrial bird that breeds in a variety of shrub/desert habitats of Uzbekistan during the spring and migrates to southern nations of central Asia during the winter. Classified as a Vulnerable

species at both national and international levels, this species was a focus of baseline field surveys. Spring 2023 baseline surveys conducted within the Project area did not result in the detection of this species, and on the basis of this survey, the national ornithologist who conducted the survey concluded that the growth of Saxaul and other shrubs within the Project site is generally too tall to support breeding of this species, which generally prefers more open desert habitats with shorter shrub growth for breeding. It is, nonetheless, considered possible that small numbers of individuals of this species could pass through the site during migration.

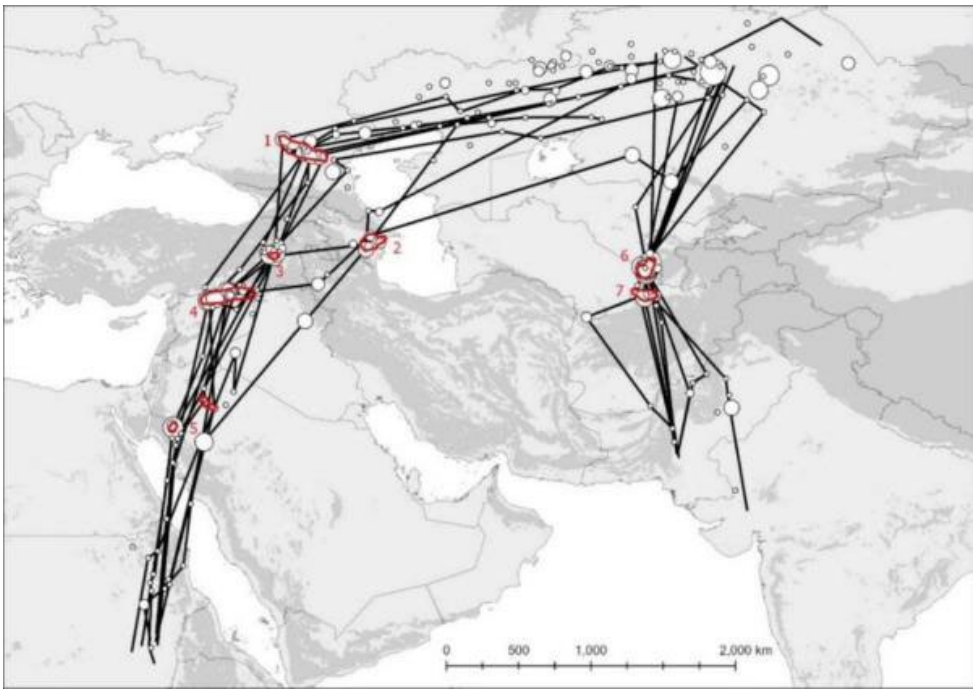
5.6.4.6 Sociable Lapwing *Vanellus gregarius*

The Sociable Lapwing is a migratory shorebird that is known to migrate through Uzbekistan, breeding in nations further north, and wintering in areas further south. It is classified as a Vulnerable species at the national level, but IUCN classifies it as Critically Endangered (CR) globally.

Up to 35% of the global population of this species is believed to migrate through Uzbekistan. During autumn migration, Sociable Lapwings concentrate around waterbodies with suitable shoreline habitats in Uzbekistan, primarily in the eastern portion of the country (Figure 84), to the east of the Project location, and birds may stay for up to several weeks, and reach significant concentrations at these migratory stopover points. Spring migration of Sociable Lapwings through Uzbekistan is believed to be more rapid and more geographically dispersed. Based on this understanding of the Sociable Lapwing's migratory patterns through Uzbekistan, it is believed that they are more likely to pass through the Project region in spring than in autumn migration.

Baseline surveys conducted within the Project area, which covered this species' spring migratory period, did not result in the detection of this species, and none of the limited wetland habitats within the EAAA appear to provide a significant amount of suitable migratory stopover habitat for this species. It is, nonetheless, considered possible that small numbers of individuals of this species could pass through the site during migration.

Figure 84: Migratory pathways of Sociable Lapwings in central Asia, as documented through satellite telemetry studies (Source: https://www.rdsconservation.com/team-sociable-lapwing-in-kazakhstan/)



5.6.4.7 Dalmatian Pelican *Pelecanus crispus*

The Dalmatian Pelican breeds on islands in large lakes across a wide area of southern Europe and central Asia, migrating to spend the winter in large lakes in India and elsewhere in southern Asia. In the Project region, this species occurs primarily as a migrant, at which time it may use the Amu Darya as a migratory corridor. Baseline ornithological surveys conducted at the Project area and nearby wetlands did not result in the detection of this species, though it is considered possible for migratory flocks or individuals of this species to pass through the area during migration.

5.6.4.8 Egyptian Vulture *Neophron percnopterus*

The Egyptian Vulture is a migratory species that breeds across a wide range of dry habitats with some mountainous relief within Uzbekistan, occurring in the country generally from April through September, overwintering in more southerly latitudes.

This species was not observed during the baseline survey effort for the Project. The relatively small size of the Project area, and the lack of mountains or rocky massifs in close proximity to the Project suggest that the area is not likely to support a high concentration of breeding of this species, though it is possible that the species could occur as a rare migrant or scarce breeder within the region.

5.6.4.9 Pallas's Fish-Eagle *Haliaeetus leucoryphus*

The Pallas's Fish-Eagle is a migratory eagle species that breeds in north central Asia, from the Caspian Sea eastward, and winters in southern Asia. During all seasons, this species is highly piscivorous, and it is strongly associated with aquatic habitats.

This species was not observed during the baseline survey effort for the Project, and it is generally considered a very rare species in the region, which is located at the western extreme of its global distribution. There is some potential for this species to occur at the site, but only as a rarity.

5.6.4.10 Steppe Eagle *Aquila nipalensis*

The Steppe Eagle occurs in Uzbekistan primarily as a migrant when it may occur broadly throughout the whole country. Small numbers of Steppe Eagles are also known to winter and to breed within Uzbekistan.

Two individuals, presumed to be spring migrants engaged in migration activity, were observed within the EAAA, roughly 6 km from the Project area, on 02 March 2023 during the baseline survey effort for the Project, and this species is considered to be an uncommon, though regular migrant through the Project area.

Figure 85: Steppe Eagle

5.6.4.11 Saker Falcon *Falco cherrug*

The Saker Falcon (Figure 86***Error! Reference source not found.***) is a partially migratory falcon species of Asian desert and mountain habitats that may be present within Uzbekistan year-round. This species was not observed during the baseline surveys for the Project, but it could possibly occur within the EAAA as a rarity in any season.

Figure 86: Saker Falcon

5.6.5 Reptiles

5.6.5.1 Methods

The herpetological baseline characterization was developed using a combination of desk-based review of secondary information sources and primary data gathering through a field survey effort conducted within the Project area. Desktop research included review of the scoping report[97], as well as a comprehensive review of available technical literature on the reptiles and amphibians of Uzbekistan, and review of publicly available databases including, but not limited to the IUCN Red List of Threatened Species and Reptile database.

The baseline survey effort was designed and conducted by Uzbek herpetologists Timur Abduraupov and Dmitriy Bondarenko. The methodology selected for the herpetological baseline survey effort consisted of three days of field survey during 09 and 11 April 2023, during which time the Project area was searched exhaustively for evidence of Central Asian Tortoise presence (including burrows), and opportunistic nocturnal and diurnal surveys broadly targeted at all possible reptiles and amphibians that could occur in the Project area were conducted. The herpetologists conducting the surveys noted that due to the relatively warm and wet conditions they encountered at the site during this visit, the conditions for herpetological surveys were excellent, and they observed signs of spring emergence of many of the region's reptiles, including some species that typically emerge from hibernation during the middle portion of the spring (e.g., Desert Monitor). An additional herpetological survey was conducted on 26-27 June, 2023 in order to characterize the use of the site by species that are more active during the warmer months of the summer. A full description of the Herpetological baseline survey methods, and sampling effort is presented in Volume III, Technical Annex.

5.6.5.2 Sensitive Reptile and Amphibian Species

A set of one amphibian and fifteen reptiles was identified as potentially occurring in the Project area (Table 38). Of these, only one species, the Central Asian Tortoise (*Testudo horsfieldii*, IUCN and UzRDB VU) meets the EBRD criteria to be classified as a PBF, and this species is evaluated in a

[97] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

separate subsection below. Field surveys of the site, including preliminary surveys conducted for the E&S scoping study[98], an initial walkover survey conducted for this ESIA on 02 March 2023, and comprehensive herpetological baseline surveys conducted at the site on 09 May to 11 May 2023, documented the occurrence of 9 species: one amphibian and eight reptiles, at the site (Table 38). Additional information on all reptile species is presented within the herpetological baseline survey report (Volume III – Technical Annexes).

Table 38: Reptile and amphibian species potentially occurring and documented at the Nur-Bukhara Solar Project site. IUCN status is LC (Least Concern), and national status is unlisted, unless otherwise noted.

№	Species	Species presence acc. to literary sources	Presence Documented at Site in Baseline Survey	Abundance (general, not site-specific)	Countries where it occurs	Conservation status		
						UzRDB	IUCN	CITES
Amphibians								
Family *Bufonidae* (toads)								
1	Turan Toad *Bufotes turanensis*	+	+	Common	UZ, TJ, TM	-	LC	
Reptiles								
Family *Testudinidae* (tortoises)								
1	Central Asian Tortoise *Testudo horsfieldii*[99]	+	+	Common	UZ, TJ, TM, KZ, IR, AF, ARM, AZER, CHN, KRG, PK, RU	VU	VU	II
Family *Gekkonidae* (geckoes)								
2	Comb-toed gecko *Crossobamon eversmanni*	+		Low numerous	UZ, TJ, TM, KZ, IR, AF	-	LC	
3	Common Wonder Gecko *Teratoscincus scincus*	+		Common	UZ, TJ, TM, KG, IR, CN	-	LC	
Family *Agamidae* (agamas)								
4	Steppe agama *Trapelus sanguinolentus*	+	+	Common		-	LC	
5	Lichtenstein's Toadhead Agama	+	+	Numerous	UZ, TM, KZ, AF, IR	-	LC	

[98] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

[99] Presence has been documented on site since the team observed and photographed a likely tortoise burrow during the March 2 walkover visit, and although not seen since, despite exhaustive survey work, in the interest of caution, it has been included.

№	Species	Species presence acc. to literary sources	Presence Documented at Site in Baseline Survey	Abundance (general, not site-specific)	Countries where it occurs	Conservation status		
						UzRDB	IUCN	CITES
	Phrynocephalus interscapularis							
Family *Lacertidae* (true lizards)								
6	Rapid Lizard *Eremias velox*	+		Numerous		-	LC	
7	Reticulate racerunner *Eremias grammica*	+	+	Numerous		-	LC	
8	Striped racerunner *Eremias lineolata*	+	+	Common		-	LC	
Family *Varanidae* (monitor lizards)								
9	Caspian Monitor *Varanus griseus caspius*	+	+	Rare		2 (VU:D)	LC	I
Family *Boidae* (Boas)								
10	Desert sand boa *Eryx miliaris*	+	+	Rare		3 (NT)	LC	II
Family *Colubridae* (colubrid snakes)								
11	Sand racer *Psammophis lineolatus*	+	+	Common		-	LC	
12	Spotted whip snake Hemorrhois ravergieri	+		Common		-	LC	
13	Spotted desert racer *Platyceps karelini*	+		Low numerous		-	LC	
14	Diadem snake *Spalerosophis diadema*	+		Low numerous		-	LC	
15	Dice snake *Natrix tessellata*	+		Common		-	LC	

5.6.5.3 Central Asian Tortoise *Testudo horsfieldii*

The Central Asian, or Russian Tortoise (Figure 87**Error! Reference source not found.**), classified as a Vulnerable species on both national and IUCN global red lists, is endemic to Central Asia. It is believed to be undergoing population declines both globally and nationally within Uzbekistan. It inhabits both sandy and clayey deserts, plains, mountain slopes, depressions and valleys, gorges and mountain steppe up to 1,150 m above sea level. It also can inhabit agricultural lands – on the edges of irrigated and unirrigated fields, in vegetable gardens and orchards, though it is generally

rarer in such habitats than in natural habitats. It generally avoids places with dense grass cover, as well as areas grazed intensively by livestock.

Tortoise populations are subject to significant fluctuations, which depend on winter and spring meteorological conditions, as well as the abundance of food. The cultivation of virgin lands, livestock grazing and the use of natural habitats by humans significantly affect its population. Central Asian Tortoise is also a subject of illegal trade in Uzbekistan. It hibernates in winter and has a period of aestivation in summer, being active only three months (from March till May) during a year. Figure 88 illustrates its area of its distribution within Uzbekistan. On the basis of this distribution, it is possible that this species could occur within the Project region.

The initial field surveys of the Project site conducted during the scoping study did not produce evidence of tortoise occurrence at the Project site, though the scoping report noted that they could potentially be present[100]. During the initial ecological walkover survey conducted by the Juru team on March 2, 2023, one hole believed to be a Central Asian Tortoise burrow was found at the site (Figure 87). However, during the comprehensive herpetological baseline surveys conducted by Uzbek herpetologists T. Abdurapov and D. Bondarenko on 9-11 April 2023, no burrows or other evidence of Central Asian Tortoise presence on the site was found, in spite of an exhaustive search of the area that was largely focused on this species (ESIA Volume III – Technical Appendix)

After this survey, the herpetologists concluded that although the area appears to be suitable for tortoises, the geomorphologic conditions, and specifically the presence of impenetrable bedrock close to the surface, with only a thin layer of sand above it, renders the area unsuitable for tortoises, as they are not able to burrow to sufficient depth. In view of all the available evidence, it is not clear whether or not the Nur-Bukhara Project area is occupied at all by Central Asian Tortoises. If it is used by this species at all, the abundance of this species within the area is very low.

[100] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

Figure 87: Central Asian tortoise. Photo by T. V. Abduraupov

Figure 88: Map of the areal and known locations of the Central Asian tortoise in various regions of the Republic of Uzbekistan

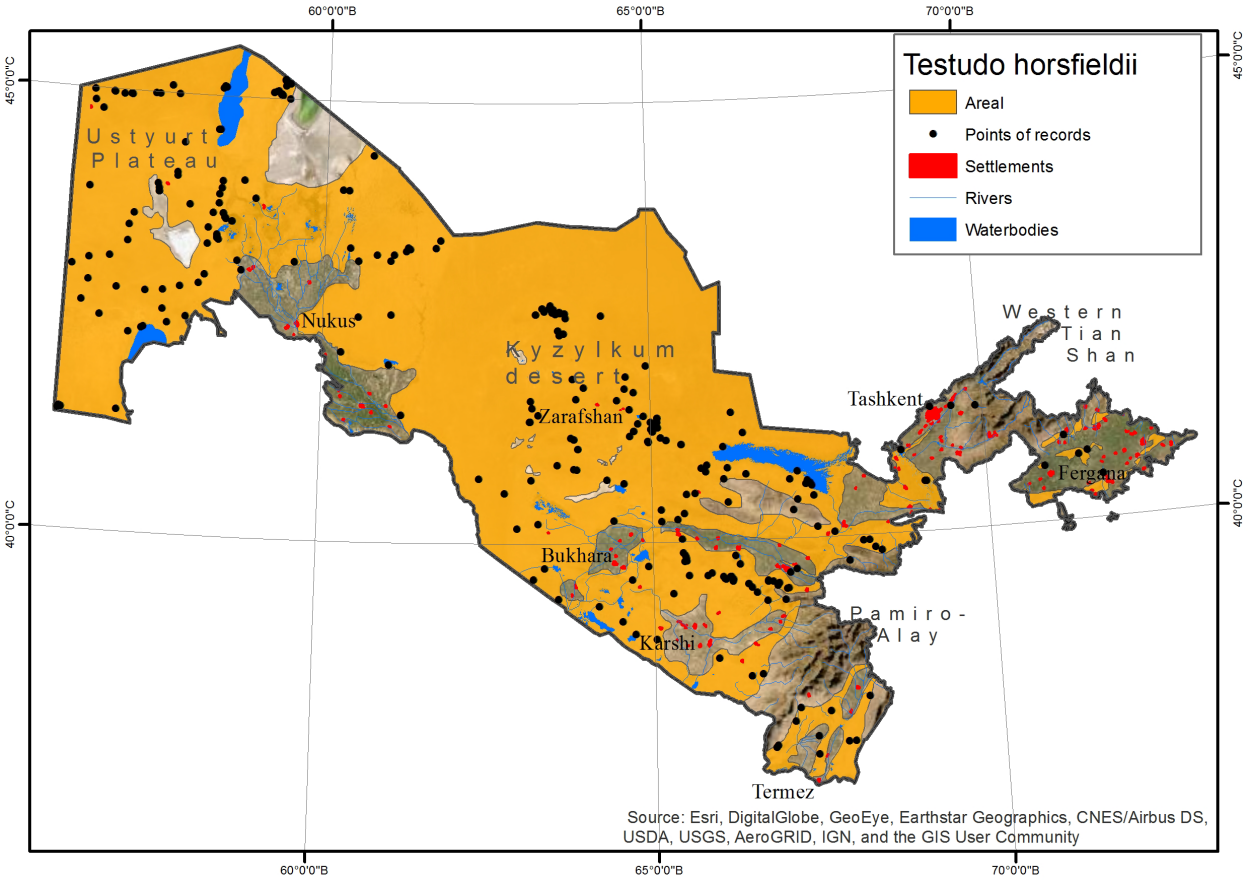


Figure 89: Hole believed to be a burrow of Central Asian Tortoise observed at the Nur-Bukhara Project site during the walkover visit in March 2023

5.6.6 Mammals

5.6.6.1 Methods

The mammal baseline characterization was developed using a combination of desk-based review of secondary information sources and primary data gathering through a field survey effort conducted within the Project area. Desktop research included review of the E&S scoping report[101], as well as a comprehensive review of available technical literature on the mammals of Uzbekistan, as well as review of publicly available databases including, but not limited to the IUCN Red List of Threatened Species.

The baseline survey effort was designed and conducted by Uzbek mammologist Mariya Gritsina. The methodology selected for the mammal baseline survey effort consisted of three days of field survey work, during 15 to 17 April 2023, during which time the Project area was surveyed for evidence of mammal presence, with a focus on rare and sensitive species. This included an exhaustive survey of 9.5 km of waterways (6.5 km of ABIS channel bordering the Project area, and 3 km of saline drainage channels and small ponds located roughly 0.8 km west of the Project area) for evidence of Central Asian Otter occurrence, or use of riparian zones by other mammals (e.g., for drinking). The mammal baseline survey effort also included interviews with local shepherds to determine whether any of them were aware of the presence of certain mammal species in the vicinity of the Project area. A full description of the mammal baseline survey methods, and sampling effort is presented in ESIA Volume III, Technical Appendix.

[101] TYPSA, 2022. Uzbek Solar 3: Technical, Environmental, and Social Consultant, Bukhara Environmental & Social Scoping Report. Produced for the International Finance Corporation (IFC), draft dated 11 February 2022.

5.6.6.2 Sensitive Mammal Species

A set of twenty-three mammal species was identified as potentially occurring in the Project area (Table 39). Of these, two species, the Central Asian Otter (*Lutra lutra*, IUCN NT and UzRDB EN) and the Goitered Gazelle (*Gazella subgutturosa*, IUCN and UzRDB VU) have been classified at PBF for the Project, and these species are evaluated in separate subsections below. Field surveys of the site, including limited surveys conducted for the scoping study, an initial walkover survey conducted by the Juru team on 02 March 2023, and the more comprehensive set of mastozoological baseline surveys conducted at the site on 15-17 April, 2023, collectively documented the occurrence of 9 species of mammal at the site (Table 39). Additional information on all mammal species is presented within the mastozoological baseline survey report (ESIA Volume III – Technical Annexes).

Table 39: Mammal species potentially occurring and documented at the Nur-Bukhara Solar Project site. IUCN status is LC (Least Concern), and national status is unlisted, unless otherwise noted.

Scientific Name	Common name	IUCN global status[102]	Uzbekistan Red Data Book status[103]	Documented at Site?
Hemiechinus auratus	Long-eared Hedgehog	LC	-	
Hemiechinus hypomelas	Brandt's Hedgehog	LC	NT	
Lepus tolai	Tolai Hare	LC	-	X
Spermophilus fulvus	Yellow ground squirell	LC	-	
Spermophilus leptodactylus	Long-clawed Ground Squirrel	LC	-	X
Ellobius tancrei	Zaisan Mole Vole	LC	-	
Mus musculus	House Mouse	LC	-	
Nesokia indica	Short-tailed Bandicoot Rat	LC	-	
Meriones tamariscinus	Tamarisk Jird	LC	-	
Meriones libycus	Libyan Jird	LC	-	X
Meriones meridianus	Mid-day Gerbil	LC	-	X
Rhombomys opimus	Great Gerbil	LC	-	X
Vulpes corsac	Corsac Fox	LC	VU	
Vulpes vulpes	Red Fox	LC	-	X
Canis aureus	Golden (Indian) Jackal	LC	-	X
Mustela eversmanni	Steppe (Asiatic) Polecat	LC	VU	
Vormela peregusna	Marbled Polecat	VU	VU	
Lutra lutra	Central Asian Otter	NT	EN	
Felis chaus	Jungle Cat	LC	-	
Felis margarita	Sand Cat	LC	NT	
Caracal caracal	Caracal	LC	CR	
Sus scrofa	Wild Boar	LC	-	
Gazella subgutturosa	Goitered Gazelle	VU	VU	X
Myocastor coypus	Nutria / Coypu	LC	-	X

[102] IUCN Red List of Threatened Species, accessed 21 May 2023
[103] Government of Uzbekistan, 2019. Animal Red Data Book.

5.6.6.3 Central Asian Otter *Lutra lutra*

The Central Asian Otter (IUCN NT, UzRDB EN) is a piscivorous mammal, highly adapted to, and associated with freshwater aquatic habitats, that has a wide distribution across most of Eurasia. It is a declining species, threatened by human persecution and alteration of rivers and other aquatic habitats, though it can occur in a wide variety of aquatic habitats, including human used and human modified wetlands and waterways[104]. In Uzbekistan, the species has undergone significant recent population declines, and is currently restricted to certain portions of the Amu Darya River system, as well as rivers of western Pamir-Alay[105].

The scoping report and desktop review indicated that otters could potentially occur in the vicinity of the Project area, either in the ABIS canals that border the Project area, or in the corridor of small, ephemeral wetlands and ponds that runs N-S roughly a kilometer west of the Project area, but no evidence of otters at the site was produced during the preliminary scoping surveys/walkovers. During the baseline surveys conducted in April 2023, the Juru mastozoologist, Mariya Gritsina, conducted an exhaustive survey of the banks of the waterways located within the EAAA used to assess this species, and did not find any evidence of otter presence, concluding that otters are not residing within the area, though it is possible that they could pass through on occasion.

5.6.6.4 Goitered Gazelle *Gazella subgutturosa*

The Goitered Gazelle is classified as Vulnerable on both the national and global (IUCN) red lists, also listed in Annex II of CMS. It is patchily distributed and believed to be declining throughout its range. The current population throughout the Uzbekistan has recently been estimated at 4,000 individuals[106].

During the baseline survey conducted in April 2023, a single trace of Goitered Gazelle (hoofprint) was found on the western side of the drainage channels and ponds located roughly 0.8 km west of the Project area (Figure 91). According to interviews with local shepherds, conducted as part of the mammal baseline study, Goitered Gazelles do not use the sandy desert habitat, but occasionally come into the wetlands to drink, especially during the hottest times of year. According to the national mammal expert who conducted the baseline surveys, the vegetation type that covers most of the Project area, itself, is not suitable for gazelles, as the shrubs are tall, and gazelles prefer more open habitats (i.e., with lower stature shrubs).

[104] IUCN Red List of Threatened Species, accessed 21 May 2023
[105] Government of Uzbekistan, 2019. Animal Red Data Book of Uzbekistan.
[106] Uzbekistan Government, 2019. National Animal Red Data Book of Uzbekistan.

Figure 90: Goitered Gazelle. Photo by Mariya Gritsina.

Figure 91 Goitered Gazelle hoofprint found during the baseline mammal survey for the Nur-Bukhara Solar Project, discovered near the shoreline of a small wetland roughly 1km to the west of the Project area

5.6.7 Fish

The baseline characterization relied on a walkover site visit, conducted in March, 2023, to evaluate the presence of fish habitats, combined with a desktop review of available information conducted by Uzbek ichtyologist, Akbarjon Rozimov, who was able to access recent information from the State Committee on Ecology and Environmental Protection (SCEEP) regarding fish survey results from the ABIS canals, as well as recent records of the release of poached fish into the ABIS canal system. The CHA for CR/EN fish species conservatively assumed that any fish species documented to occur in the ABIS canals in SCEEP's records from within the past 5 years (2018 or later) was present at the site, if suitable habitat was present.

The fish baseline characterization focused on four species of globally CR/EN fish that could potentially occur within the ABIS canals in the vicinity of the Project site, and that were classified as PBF for the Project, as follows:

- Amu-Darya Shovelnose Sturgeon *Pseudoscaphirhynchus kaufmanni* (IUCN RL CR, UzRDB CR)
- Small Amu-Darya Shovelnose Sturgeon *Pseudoscaphirhynchus hermanni* (IUCN RL CR, UzRDB CR)
- *Capoetobrama kuschakewitschi* (IUCN EN, UzRDB VU)
- *Aspiolucius esocinus* (IUCN EN, UzRDB EN)

The scoping site visit, conducted on March 2, 2023 confirmed that suitable habitat for all four of these species is present in the ABIS canals that border the Project site on three sides, as well as nearby connecting canals within the ABIS system, and review of SCEEP records indicated that all four species have been documented within the ABIS canals system within the past 5 years (Volume III, Technical Annex, TA05), hence all four species are assumed to be present within the Project's EAAA.

It is important to note that the ecological value of the four CR/EN species' populations contained within the ABIS canal system is limited and questionable, given that the fish located in the canals may be completely cut off from their source populations. In the ABIS system, water is pumped from the main Amu Darya River channel through the canals in order to supply agricultural areas in the Bukhara region with water for irrigation. The pumping stations that actively generate this flow of water, may represent "one-way doors" for fish, causing fish that pass through a pumping station and wind up in the ABIS canal system to be permanently cut off from their source population within the main Amu Darya channel (A. Rozimov, pers. comm.). Nonetheless, these four species are considered as PBF for the Project, potentially impacted by any disturbance of, or inputs of soil, water, or other substances into the ABIS canals that surround the Project area, e.g., as a result of Project construction activities.

5.6.8 Critical Habitat Assessment Summary

A Critical Habitat Assessment (CHA) was performed to support the baseline biodiversity characterization and impact assessment sections of the ESIA. This CHA followed the procedures and applied the criteria and definitions used in both IFC PS6 and EBRD PR6, synthesizing information from desktop-level review, site-specific field surveys, and consultation with regional experts to identify all species and other biodiversity features that trigger a determination of CH (IFC PS6 or EBRD PR6) or a Priority Biodiversity Feature (PBF, EBRD PR6). In addition, the CHA included an assessment of Natural Habitat (NH), under the definitions and criteria presented in IFC PS6. The full CHA is included as a standalone document, and the results of the CHA are briefly summarized here.

No species or other biodiversity features were identified as triggering a CH determination for the Project under either IFC PS6 or EBRD PR6. Nineteen species were identified as PBF under EBRD PR6 (Table 40), and one habitat type was identified as Natural Habitat under IFC PS6 (Table 40).

Table 40 Summary of the results of the Critical Habitat, Natural Habitat, and Priority Biodiversity Features Assessment for the Nur-Bukhara PV Solar Project.[107]

Feature [108]	Higher taxon	IUCN global status [109]	Uzbek status[110]	Applicable CH/PBF criterion[111]			EAAA	IUCN minimum global population estimate[112]	Determination [113]	Rationale
				Threatened/VU Species	RR Species	Migratory /Congregatory Species				
				CH criterion ii, PBF criterion ii	CH criterion iii, PBF criterion ii	CH criterion iv, PBF criterion ii				
Calligonum matteianum	Plant	EN	2 (rare)	X			1	N/A	PBF	Population in Project EAAA is <0.5% of global population
Calligonum molle	Plant	EN	2 (rare)	X			1	N/A	PBF	Population in Project EAAA is <0.5% of global population
Calligonum paletzkianum	Plant	VU	3 (vulnerable)	X			1	N/A	PBF	Project not likely to result in species' up-listing to globally CR/EN

[107] Status categories for the IUCN and Uzbek animal red lists are as follows: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; (blank) = Least Concern (IUCN) or not listed (Uzbek); NA = not assessed. For the Uzbek plant red list, status category is provided as published in the red list, and the rough equivalent in terms of IUCN categories is also provided. See text for additional justification of CH/PBF determinations. Ecologically Appropriate Areas of Analysis (EAAA) were defined based on species-specific ecological considerations, per EBRD PR6, and the numbers listed in the table correspond to those listed in the table

[108] The ecosystems and habitats potentially affected by the Project did not meet any of the criteria for "priority ecosystems," including "threatened ecosystems," "highly threatened or unique ecosystems" (IFC CH criterion 4 = EBRD CH criterion i), "areas associated with key evolutionary processes" (CH criterion v), or "threatened habitats" (PBF criterion i) as defined in EBRD PR6 and the associated Guidance Note 6. Neither were the criteria met for any "significant biodiversity features identified by a broad set of stakeholders or governments" (PBF criterion iii), or "ecological structure and functions needed to maintain the viability of priority biodiversity features" (PBF criterion iv), hence the only biodiversity features included in this table are species (and their habitats) that met one or more of the species-specific CH or PBF criteria/thresholds, as described in the table.

[109] https://www.iucnredlist.org/ accessed 4 May 2023

[110] Separate Uzbek national red lists for plants and animals, both published by the Uzbekistan ministry of environment in 2019.

[111] Uzbekistan is neither a member of the EU, nor a Bern Convention signatory, hence the specific CH/PBF criteria relating to habitats and species that receive special protection under EU nature legislation are not considered applicable, per EBRD GN6.

[112] https://www.iucnredlist.org/ accessed 4 May, 2023

[113] PBF = Priority Biodiversity Feature, per EBRD PR6; NH = Natural Habitat, per IFC PS6

Feature [108]	Higher taxon	IUCN global status [109]	Uzbek status[110]	Applicable CH/PBF criterion[111]			EAAA	IUCN minimum global population estimate[112]	Determination [113]	Rationale
				Threatened/VU Species	RR Species	Migratory /Congregatory Species				
				CH criterion ii, PBF criterion ii	CH criterion iii, PBF criterion ii	CH criterion iv, PBF criterion ii				
White-headed Duck	Bird	EN	EN	X		X	1	5,300	PBF	Population in Project EAAA is <0.5% of global population, EAAA not likely to contain ≥ 1% of the global population at any point in species' life cycle
Marbled Teal	Bird	NT	EN	X		X	1	10,000	PBF	EAAA not likely to satisfy trigger for IFC PS6 CH criterion iic (nationally important concentration), EAAA not likely to contain ≥ 1% of the global population at any point in species' life cycle
Macqueen's (Asian Houbara) Bustard	Bird	VU	VU	X		X	2	33,000	PBF	Project not likely to result in species' up-listing to globally CR/EN, EAAA not likely to contain ≥ 1% of the global population at any point in species' life cycle
Sociable Lapwing	Bird	CR	VU	X		X	1	11,200	PBF	EAAA not likely to support ≥ 0.5% of the global population and ≥ 5 reproductive units, nor to contain ≥ 1% of the global

Feature [108]	Higher taxon	IUCN global status [109]	Uzbek status[110]	Applicable CH/PBF criterion[111]			EAAA	IUCN minimum global population estimate[112]	Determination [113]	Rationale
				Threatened/VU Species	RR Species	Migratory /Congregatory Species				
				CH criterion ii, PBF criterion ii	CH criterion iii, PBF criterion ii	CH criterion iv, PBF criterion ii				
										population at any point in species' life cycle
Dalmatian Pelican	Bird	NT	EN	X		X	1	11,400	PBF	EAAA not likely to contain ≥ 1% of the global population at any point in species' life cycle or satisfy trigger for CH criterion iic (nationally important concentration)
Egyptian Vulture	Bird	EN	VU	X		X	2	12,400	PBF	EAAA not likely to support ≥ 0.5% of the global population and ≥ 5 reproductive units, nor to contain ≥ 1% of the global population at any point in species' life cycle
Pallas's Fish-Eagle	Bird	EN	EN	X		X	2	1,000	PBF	Population in Project EAAA is <0.5% of global population, EAAA not likely to contain ≥ 1% of the global population at any point in species' life cycle
Steppe Eagle	Bird	EN	VU	X		X	2	50,000	PBF	EAAA not likely to support ≥ 0.5% of the global population and ≥ 5 reproductive units, nor to

Feature [108]	Higher taxon	IUCN global status [109]	Uzbek status[110]	Applicable CH/PBF criterion[111]			EAAA	IUCN minimum global population estimate[112]	Determination [113]	Rationale
				Threatened/VU Species	RR Species	Migratory /Congregatory Species				
				CH criterion ii, PBF criterion ii	CH criterion iii, PBF criterion ii	CH criterion iv, PBF criterion ii				
										contain ≥ 1% of the global population at any point in species' life cycle
Saker Falcon	Bird	EN	EN	X		X	2	12,200	PBF	EAAA not likely to support ≥ 0.5% of the global population and ≥ 5 reproductive units, nor to contain ≥ 1% of the global population at any point in species' life cycle
Russian Tortoise	Turtle	VU	VU	X			1	Unknown, but occurs widely across 12 Asian countries	PBF	Project not likely to result in species' up-listing to globally CR/EN
Goitered Gazelle	mammal	VU	VU	X			2	42,000	PBF	Project not likely to result in species' up-listing to globally CR/EN
Central Asian Otter	mammal	NT	EN	X			1	57,880	PBF	EAAA not likely to satisfy trigger for IFC PS6 CH criterion iic (nationally important concentration),
Amu-Darya Shovelnose Sturgeon	Fish	CR	CR	X			3	unknown	PBF	Population in Project EAAA is <0.5% of global population

Feature [108]	Higher taxon	IUCN global status [109]	Uzbek status[110]	Applicable CH/PBF criterion[111]			EAAA	IUCN minimum global population estimate[112]	Determination [113]	Rationale
				Threatened/VU Species	RR Species	Migratory /Congregatory Species				
				CH criterion ii, PBF criterion ii	CH criterion iii, PBF criterion ii	CH criterion iv, PBF criterion ii				
Small Amu-Darya Shovelnose Sturgeon	Fish	CR	CR	X			3	unknown	PBF	Population in Project EAAA is <0.5% of global population
Aspiolucius esocinus	Fish	EN	EN	X			3	unknown	PBF	Population in Project EAAA is <0.5% of global population
Capoetobrama kuschakewitschi	Fish	EN	VU	X			3	unknown	PBF	Population in Project EAAA is <0.5% of global population
Fixed sands shrub desert habitat of Sundukli Sands region	Habitat type	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NH	Baseline vegetation community of Project site contains viable assemblage of species of largely native origin, and human activity has not essentially modified the area's primary ecological functions and species composition

6 Stakeholder Engagement

6.1 Introduction

A Stakeholder Engagement Plan (SEP) has been prepared as part of this ESIA that outlines legal and lender obligations, detailed stakeholder mapping, an overview of engagement performed to date (also summarised below), stakeholder engagement principles, the requirements for the ESIA phase and beyond, and the Project Grievance Mechanism.

6.2 Summary of SE during ESIA

During the scoping site visit on 2-3 March 2023 a number of consultations were conducted with stakeholders at the following locations:

- Alat district municipality.
- Khamza 1 substation – CNTIC company.
- Khamza 2 substation - CNNC Ind. Company.
- Shaxram omad LLC farm.
- Main Electricity Grids of Bukhara Department.
- Alat District Power Grids Department.
- Alat District Cadastral Department.
- Alat District Construction Department.
- Alat District Sanitary Epidemiological Wellbeing Department.
- Alat District Natural Resources Department.
- Kirlishon and Kulchovdur communities' representatives
- Amu Bukhara Main Canal Department.

Figure 92: Scoping Engagement

a. CNTIC company workers

b. Farmer outside the Project site

c. CNNC Ind. company workers

d. Main Electricity Grids Department worker

e. ABMC workers
(pumping station 16 of Khamza 1 substation)

f. Kirlishon community members

g. Kirlishon community members

h. Chairman of Kirlishon community

i. Chairman of Kulchovdur community

j. Kulchovdur community members

k. Kulchovdur community members

l. Alat District Power Grids Department

m. Alat District Natural Resources Department

n. Alat District Cadastral Department

o. Alat District Construction Department

During the meetings participants were provided with leaflets with the key information about the planned project as well as contact details of the ESIA Consultant. A sample of the leaflet is provided in SEP, Annex A.

6.3 Stakeholder consultations at ESIA stage

During site visits in May 2023, the following activities were undertaken to inform the preparation of the ESIA:

1. Business correspondence;
2. Focus group discussions (FGDs);
3. Key informant interviews (KIIs);
4. Socioeconomic surveys; and
5. Public hearings (discussed in section 2.4).

As with the scoping phase, during the meetings, participants were provided with project information about the planned Project as well as contact details of the ESIA Consultant. The summary of meetings with local social receptors is summarised the SEP.

Table 41: Summary of the Stakeholder engagement

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
Institute of Archaeology under Academy Sciences of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 13 March 2023	Institute has conducted archaeological surveys at the Project site and their conclusion has been received. Results of surveys will be included to the ESIA report	n/a	A request has been included in ESIA	Project information
Cultural Heritage Agency of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 14 March 2023 Response received 17 March 2023	Confirmed that there are no objects of tangible and intangible cultural heritage registered under state protection within the project area or within 500 meters radius of it.	n/a	n/a	Project information
Institute of Botany under Academy Sciences of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 16 March2023 Response received 20 April 2023	The Institute provided a detailed list of the previous recent botany surveys undertaken within or near the Project site and shared links to relevant open data. It had no comments on the Project.	n/a	n/a	Project information
Ministry of Mining Industry and Geology of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 31 March 2023 Response received 11 May 2023	Ministry stated that there are no ongoing mining activities at the Project site or within 500 meters of the project. Also, no activities are planned during Project implementation.	n/a	n/a	Project information

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
Chamber of State Cadastres of Bukhara Region	Business correspondence	n/a	Letter sent – 31 March 2023 Response received 12 April 12 2023	The Chamber stated that cadastral documents of land users and the cadastral volume all belong to the State Committee for the Development of Silk and Wool Industry.	n/a	n/a	Project information
Sanitary and Epidemiological Welfare and Public Health Service of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 05 April 2023 Response received 28 July 2023	HPZ for PV power plants are not provided by local laws but was established as 250 meters on the basis of technical data sheets (passports) provided by the manufacturers of power plant equipment and the results of appropriate calculations of the electrical magnetic field distribution on the environment.	n/a	n/a	Project information
Ministry of Natural Resources	Business correspondence	n/a	Letter sent – 10 April 2023 Response received – 17 April 2023	The Ministry stated that based on the Law “On hunting” (article 30) it is necessary to obtain permission from the Academy of Science in order to conduct fish surveys in canal.	n/a	n/a	Project information
Ministry of Natural Resources	Business correspondence	n/a	Letter sent – 13 April 2023 Response received – 25 April 2023	The Ministry recommended involving specialists from the Academy of Sciences and other relevant agencies to obtain scientifically substantiated information on the availability and condition of flora and fauna objects needed for ESIA of the Project.	n/a	n/a	Project information

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
Bukhara Regional Department of the Ministry of Natural Resources of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 13 April 2023 Response has not been received yet	Waiting for response letter. Follow up call revealed that they need some time to respond to the letter.	n/a	n/a	Project information
The Society for the Protection of Birds of Uzbekistan, The official representative of Bird Life International in Uzbekistan	Business correspondence	n/a	Letter sent – 13 April 2023 Response received – 17 April 2023	As the official representative of Bird Life International, they noted that the biodiversity studies of the site mentioned in Juru's letter were conducted in 2022 by the employees of "Nazar Business and Technology" (NBT) on behalf of the IFC. To obtain the requested information, they recommend contacting the management of this company.	n/a	n/a	Project information
Institute of Botany under Academy Sciences of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 13 April 2023 Response received – 20 April 2023	The Institute stated the following: - Results of research conducted by the Institute between 2018-2020 are available on the web with free access; - Results of inventory surveys of endemic flora species are available for free only for state organisations. All other parties can purchase this information; - Institute also has relevant information about current state of	n/a	n/a	Project information

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
				the environment at the Project site that can be purchased; - The Institute is happy to provide its services in conducting flora surveys for the Project, if required.			
Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 13 April 2023 Response received 17 April 17 2023	The Institute of Botany has expressed their willingness to collaborate with Juru Energy in conducting biodiversity surveys on a contractual basis	n/a	n/a	Project information
Bukhara state university	Business correspondence	n/a	Letter sent – 01 May 2023 Response received – 26 June 2023	Bukhara state university has expressed their willingness to collaborate with Juru Energy in conducting biodiversity surveys on a contractual basis	n/a	n/a	Project information

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
Amu Bukhara Main Canal Department	Business correspondence	n/a	Letters sent – 19 April 2023 and 27 April 2023 Response received – For first request – 27 April 2023, for second received on 19 May 2023	The Department provided information about measurements of water protection zone required for water discharge canals of Amu-Bukhara-1 and Amu-Bukhara-2 pumping stations as well as recommendations for determination of the protection zone dimensions in relation to the Project. They recommended a buffer zone from canal to Project of 150 meters. Follow up request has been sent asking if reduction of proposed buffer zone can be reduced. Response was received confirming 70 meters setback.	n/a	n/a	Project information
Committee for the Development of Silk and Wool Industry	Business correspondence	n/a	Letter sent – 19 May 2023 Response received 16 May 2023	The Committee stated that pasture lands mentioned in the letter were transferred to the LLC "Buhoro Karakol cluster" under the long-term agreement with Karakol cluster (28.10.2020, 02-6 number) allocated, in accordance with the Decree of the President of the Republic of Uzbekistan dated September 2, 2020, No PF-6059.	n/a	n/a	Project information
"Uztransgaz" JSC Zirabulak main gas pipelines department	Business correspondence	n/a	Letter sent – 05 April 2023	The Project area is not within the protection zone of the main gas pipelines and gas pipeline networks owned by the department.	n/a	n/a	Project information

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
			Response received – 20 April 2023				
"Hududgaztaminot" JSC	Business correspondence	n/a	Letter sent – 05 April 2023 Response received – 11 April 2023	"Hududgaztaminot" JSC stated that there are no underground or above ground gas pipelines belonging to "Hudugaz Bukhara" Gas Supply Branch in the Project area.	n/a	n/a	Project information
Uzbektelekom JSC	Business correspondence	n/a	Letter sent – 05 April 2023 Response received 20 April 2023	Uztelecom responded that there are no optic fibre/communication cables belonging to them at the Project site. Also, the JSC stated that there is an optic fibre cable that belongs to "China Nuclear Industry 22nd Construction CO., LTD"	n/a	n/a	Project information
Bukhara regional department of ecology and environmental protection	Business correspondence	n/a	Letter sent – 08 April 2023 Response has not been received yet	Waiting for response letter. Follow up call revealed that they need some time to respond to the letter	n/a	n/a	Project information
Bukhara Regional municipality	Public hearing notification	n/a	Letter sent – 12 April 2023	Juru sent a letter to disclose the public hearing and meetings with community members of the Kirlishan and Kulchovdor LC with the participation of local activists to be held at the Alat District Municipality with the participation of stakeholder organisations.	n/a	n/a	Project leaflet

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
Alat district municipality	Public hearing notification	n/a	Letter sent – 14 April 2023	Juru sent a letter to disclose the public hearing events and meetings to be held as part of the Project.	n/a	n/a	Project leaflet
Shaxram omad LLC farm	Business correspondence	4	Notification letter sent – 24 April 2023	Juru sent a letter to conduct an inventory and socio-economic survey.	n/a	n/a	Project leaflet
State Committee on Sericulture and Wool Development Industry	Business correspondence	4	Notification letter sent – 29 April 2023	Juru sent a letter to conduct Inventory and socio-economic survey at a land plot allocated for the Project that is under ownership of Alat District Department of SWID	n/a	n/a	Project leaflet
Focus group discussions at Kirlishon[114] community	Face to face meeting	14	Conducted on 07 May 2023	The aim was to understand the scope of impact on villagers due to the land acquisition for the Project. Conversation revealed followings: - Villagers graze livestock at Project site by making agreement with SWID committee; - Livestock grazing is the only source of income for approximately 23 households;	Villages asked to move the Project to another location. Villagers asked to consider locals in first instance for work at the	Juru informed participants that request on employment opportunities will be raised with the Project Developer, and	Project leaflet

[114] FGD was held only in Kirlishon community, given the fact that only residents of this community used the Project site for grazing.

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
				- Villagers suffer from unemployment, and they need land for livestock grazing	construction stage. Villagers asked the Project to consider proposing alternative land for grazing near to their village.	consultations on obtaining alternative land will be carried out with SWID committee	
Lenders' due diligence site visit	Separate face to face meetings with municipality, local community members and PAPs	- 14 - 11 - 8	Conducted on 12 June 2023	Meetings were held to discuss the Project with stakeholders and affected people and get their feedback.	Participants concerns were regarding employment opportunities, in particular to guarantee employment for directly affected people, also repair of roads in case of damage by Project's heavy machinery	General information on employment was provided and regarding roads it was explained that in case of damage by Project, the repair of roads will be considered	n/a

Stakeholder (Organisation)	Type of Consultation	No of participants	Meeting/ Response Receipt	Summary of Discussion	Questions/ Concerns	Provided Response	Information Disclosed
Ministry of Natural Resources	Business correspondence	n/a	Letter sent – 19 May 2023 Response received – 17 April 2023	Request for collection of seeds was sent In the response letter it was stated that the request was redirected to the Cabinet of Ministers for approval	n/a	n/a	Project information
Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan	Business correspondence	n/a	Letter sent – 7 June 2023 Follow up letter was sent – 26 June 2023 Response received – 11 July 2023	A request was sent for a fish survey The Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan has expressed their willingness to collaborate with Juru Energy in conducting surveys on a contractual basis	n/a	n/a	Project information
Ministry of Natural Resources	Business correspondence	n/a	Letter sent – 17 July 2023 Response received – 3 August 2023	Request for development and coordination with the Department of protected natural areas under the MNU Measures to conserve biodiversity (vegetation, birds, reptiles, mammals and fish) included in the international Red List and the Red Book of Uzbekistan; The response letter stated that the project site is not included in the protected natural areas.	n/a	n/a	Project information

6.4 Public hearings

Public hearings are a requirement for both the national EIA and the international ESIA preparation. Summary information on public meetings have been provided in Table 41.

- 18 April 2023 - Alat municipality
- 18 April 2023 - Kulonchi community
- 18 April 2023 - Kulchovdur community
- 30 May 2023 - Alat district khokimiyat
- 30 May 2023 - Kulchovdur community
- 31 May 2023 - "Alat Qoraqolchilik" LLC and herder
- 31 May 2023 - Kirilishon community
- 31 May 2023 - Kirilishon community (eight households located near Khamza 1)
- 31 May 2023 - Household near Khamza 2 station

Participants in the public hearings were generally in agreement with the Project. Concerns were raised about the location of the Project and its impact on herders' grazing land. The option of alternative land was presented, which was accepted by the participants. Requests were also made for priority employment for local community members which will be included in Project plans and policies and a meeting with the EPC to discuss employment opportunities, which will be discussed with the EPC. Some community development activities have been suggested, these were noted by the Project Company and will be further discussed when the community development plan is prepared.

6.5 Final ESIA /LRP Disclosure

Following finalisation of the ESIA package, the following disclosure activities will be conducted:

- Final NTS and the supporting ESIA information leaflet in English and Uzbek in the Alat Khokimyat. Kulchovdir community office and Kulonchi community office.
- ESIA disclosure meeting (s) (pre-start of construction)
    - Date and venue to be to be confirmed closer to the date.
    - Information will be communicated to the stakeholders at least 14 days before the meeting via official notifications to Alat Khokimyat and community leaders and Telegram notifications.
- Disclosure of online version of complete ESIA package including executive summary of the LRP on Lender and Masdar websites.
- Disclosure of the LRP information leaflet and compensation packages (CPs) to the PAPs.

6.6 Grievance mechanism

The project has established a grievance mechanism. This is outlined in SEP (ESIA Volume V). In addition, a Grievance Redress Committee (GRC) will be defined prior to the start of construction and including representatives of the PAPs.

7 ESIA Assessment Methodology

7.1 ESIA terms of reference

A scoping assessment[115] for this ESIA was performed during March 2023 (Volume III: ESIA Technical Appendices, Scoping Report. The scoping process identified the issues and impacts to be addressed in the ESIA as summarised in Table 42. Where no impact was predicted between the Project and the receiving environment, the topics were scoped out for further assessment. The detailed explanation for scoping certain topic out can be found in the scoping report and detailed terms of reference (TOR) and also summarised throughout this report in the relevant sections below.

Table 42: ESIA terms of reference (TOR)

Environment and Health	Social	Labour
Scoped in:		
· Air quality (C/D). · Noise and vibration (C/D) · Waste (including hazardous waste) (C/O/D) · Climate resilience · Soil and (C/D) · Water resources (C/D). · Hydrogeology (C/D) · Biodiversity (habitat loss, impact on critical habitat and PBF) · Cumulative impacts (C)	· Community health and safety (C/O/D) · Traffic and Transportation (C/D) · Security (C/D) · Emergency preparedness and response (C/O/D) · Livelihood and land use (C) · Cultural heritage (C)	· Occupational Health and Safety (C/O/D) · Emergency preparedness and response (C/O/D) · Labor rights (C/O/D) · Employment (positive) (C/D) · Gender Based Violence and Harassment (GBVH) (C/D) · Human rights (C/O/D) · Procurement/supply chain (C/O/D)
Scoped out:		
· Air quality (O) · Noise (O) · Soils (O) · Landscape and visual impact (C/D) (including glint and glare) · Greenhouse gases (C/O/D) · Cumulative impacts (O) · Transboundary impacts (C/O/D) Security (O)	· EMF/EMC (O) · Radio and TV interference (C/O/D) · Traffic and transportation (O) · Cultural heritage (O) · Indigenous Peoples (C/O/D)	None
Note: C = Construction, O = Operations, D = Decommissioning		

Source: Technical Appendices, Scoping Report (Volume III: ESIA Technical Appendix).

[115] Nur Bukhara Environmental & Social Impact Assessment: Scoping Report v1.1 (03 May 2023)

7.2 ESIA methodology

7.2.1 Overview

For a robust and transparent impact assessment process, each topic will consider the **magnitude** of the impact, and the **sensitivity** of the receiving environment to evaluate the overall **significance of the impact**. A framework for assigning magnitude, sensitivity and impact significance is described below and will be defined for each impact assessment topic. For each E&S topic the potential mitigation and management measures are considered to give an overall residual impact significance conclusion. Data limitations and any uncertainties are also described.

7.2.2 Receptor sensitivity

Sensitivity criteria for receptors are categorised into high, medium, or low. Generic criteria used to determine the receptor sensitivity are provided in Table 43. Each topic specific chapter of the ESIA will define the relevant receptors and assigned a receptor sensitivity based on topic specific criteria.

Table 43: Generic criteria for the allocation of Receptor sensitivity

Sensitivity	Physical Receptor	Human Receptor	Biodiversity Receptor	Climate resilience
High	Little or no capacity to absorb proposed changes and has national or international value e.g., receptors where people or operations are particularly susceptible to noise or air quality changes)	Receptors with high vulnerability and permanent presence within the direct or indirect AOI (e.g., school, poor or vulnerable household, hospital). No capacity to absorb project changes or no opportunity for mitigation.	Receptors with high vulnerability and permanent presence within the direct or indirect AOI. No capacity to absorb project changes or no opportunity for mitigation.	Climate variability will threaten the sustainability of the project (e.g., work may be precluded from taking place during certain months of the year).
Medium	Moderate capacity to absorb proposed changes e.g., where it may cause some discomfort or distraction or disturbance.	Receptors with moderate to high vulnerability and or somewhat affected by project impacts. Limited capacity to absorb changes. Potential opportunities for mitigation	Receptors with moderate to high vulnerability and or somewhat affected by project impacts. Limited capacity to absorb changes. Potential opportunities for mitigation.	Potential impacts that can be addressed through management actions (e.g., design, implementation management).
Low	Good capacity to absorb proposed changes and not protected or has low value e.g., receptors where	Receptors with low to moderate vulnerability or are located in the AOI infrequently. Good capacity to absorb changes with no lasting effects, or good	Receptors with low to moderate vulnerability or are located in the AOI infrequently. Good capacity to	Potential impact does not affect the sustainability of the Project.

Sensitivity	Physical Receptor	Human Receptor	Biodiversity Receptor	Climate resilience
	the disturbance is minimal.	access to mitigation measures.	absorb changes with no lasting effects, or good access to mitigation measures.	

7.2.3 Impact magnitude

The magnitude of the potential impact is determined based on the professional judgement of the specialist undertaking the assessment (qualitative assessment) considering the five criteria provided in Table 44. Where impacts can also be quantified and compared against national or international standards these are also considered.

Table 44: Determination of magnitude – example criteria for allocation

Magnitude	Intensity Compliance	Duration	Spatial extent	Reversibility	Likelihood/ Frequency
High	High intensity / non-compliant / large numbers of people affected/ very disruptive	Beyond the construction phase or permanent change	Direct AOI & Indirect AOI	Permanent impact	Continuous
Medium	Medium intensity/ actions need to be taken to become fully compliant/medium disruption or disruption to vulnerable groups or sectors of the community or workforce / Quality of life diminished due to change in character	> 3 months up to completion of the construction phase	Indirect AOI	Reversible, but requires mitigation and/or compensation	Intermittent
Low	Low intensity /compliant / small numbers of people / non-intrusive or does not cause changes in quality of life	One off event or occurs for 3 months or less	Direct AOI	Reversible following end of phase under consideration	Infrequent / one-off event

7.2.4 Evaluation of significance

Based on impact magnitude and receptor sensitivity as defined above the significance of the impact is classed as neutral, minor, moderate, major or critical as presented in Table 45.

- **Critical**: These effects represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.
- **Major**: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance.

- Moderate: These effects, if adverse, while important, are not likely to be key decision-making issues.
- **Minor**: These effects may be raised but are unlikely to be of importance in the decision-making process.
- **Neutral:** No effect, not significant, noise need not be considered as a determining factor in the decision-making process

The significance of impacts will be discussed pre-mitigation and post mitigation (i.e., residual impact) for each aspect. Based on the above approach, impacts identified as having major or moderate significance will be classified as significant impacts. Impacts are typically considered to be adverse, but it is also possible for positive impacts to be realised. Where positive impacts are identified in the sections below, these are assigned a degree of positive impact based on the sustainability (duration) and scale (number of receptors) of the positive outcomes. All impacts should be considered negative unless specifically noted as positive.

Table 45: Significance evaluation

Significance		Magnitude					
		Negative			Positive		
		Low	**Medium**	**High**	**Low**	**Medium**	**High**
Receptor sensitivity	**Low**	Neutral	Minor	Moderate	Neutral	Minor	Moderate
	Medium	Minor	Moderate	Major	Minor	Moderate	Major
	High	Moderate	Major	Critical	Moderate	Major	Critical

The temporal influence of the Project has been assessed by comparing the existing baseline conditions (environmental, socio-economic and biological) over the expected duration of the Project activities as defined in Chapter 1.

7.2.5 Mitigation, enhancement and monitoring

Mitigation measures control, reduce, eliminate, or offset adverse impacts and enhance potential beneficial impacts of a development. In the mitigation section of each topic, proposed mitigation actions in accordance with the mitigation hierarchy have been defined. This includes actions to avoid or reduce significant impacts to acceptable levels in accordance with national and international standards and to align with good industry practice (GIIP) or to enhance the Project outcomes. The significance of impacts has been determined once the application of mitigation and management measures has been defined. (i.e., residual significance)

Residual impacts deemed moderate, major or critical are considered the main focus of the management and implementation framework going forward based on the following mitigation hierarchy:

- Avoidance and reduce through design (embedded mitigation)
- Abate impacts at source or receptor

- Repair, restore or reinstate to address temporary construction effects.
- Compensation for loss or damage, such as replacement planting elsewhere
- Once the application of mitigation and management measures has been defined, the residual significance will be determined.

7.2.6 Residual impacts

The determination of residual significance of impacts considers any incorporated mitigation measures adopted by the Project during design or siting and will depend on the extent and duration of change, the number of people or size of the resource affected and their sensitivity to the change. Based on the above approach, residual impacts post mitigation identified as having major or moderate significance will be classified as significant impacts.

7.2.7 Decommissioning impacts

The Project will be in operation for at least 25 years and considering the high possibility that be a continuation or refurbishment of the components to enable operation to extend beyond 25 years. Decommissioning impacts would be subject to a separate detailed assessment and (if required, as part national permitting process) when decommissioning is planned.

And that generic expected decom impacts are assessed in this ESIA for completeness.

Decommissioning sections in this chapter needs to be detailed further – currently it has no details and just says refer to construction impacts and GIIP etc. This is not enough.

7.2.8 Cumulative impacts

Positive and negative cumulative impacts that may arise from the incremental impact of the proposed Project when added to other closely related past, present and probable future projects have been assessed. Potential cumulative effects may include:

- Combined effects - those likely to occur at areas where there is a concentration of activity (batching plant area, R78 from Alat to the Project site).
- Spatial and temporal crowding - when many activities are carried out in too small an area at the same time (batching plant area, R78 from Alat to the Project site).

Strategic induced growth i.e., macro scale impacts due to the greater demand and availability of electricity and which will be an inevitable outcome of the Project are not considered further.

The following impact assessment sections have considered the first two potential cumulative effects for the Project in the direct and indirect AOI for each topic under consideration and for all Project activities. The potential for impacts has considered:

- Geographic scope;
- Pinch points (batching plant use, use of same approach road);
- Construction duration of 12 to 16 months (Q3 2023 to Q4 2024/ Q1 2025); and
- Project operation lifetime 25 years.

The assessment of cumulative impacts is based on information in the public domain regarding the identification of foreseeable projects in the region. Stakeholder engagement activities as described in section 0.0 have also helped to inform the assessment of potential cumulative impacts, in particular to identify neighbouring projects that might be undertaking construction works at the same time (as described in section 3.3).

7.2.9 Data limitations and uncertainties

Any uncertainties associated with impact prediction or the sensitivity of receptors due to the absence of data or other limitation have been considered and articulated at the end of each section. Commitments concerning measures that should be put in place for further survey work, monitoring and/or environmental or social management to deal with the uncertainty are captured in the ESMP (ESIA Volume IV).

7.2.10 Transboundary impacts

The Project site is located more than 20 km from the border with Turkmenistan and is considered outside the direct and indirect AOI for the impacts under consideration for this project as defined in the Project specific impact sections (see also Figure 33). There will be no water abstraction from transboundary water courses and there are no transboundary air quality considerations. The potential influx of people coming to work on the project is considered unlikely, due to the distance from the border and the fact that this has not occurred for the other two ongoing projects (none of the workers on the Khamza 1 and Khamza 2 projects were identified as Turkmen), Transboundary impacts have been scoped out and are not considered further in this assessment.

8 Impact Assessment

8.1 Air quality

8.1.1 Potential impacts

Increases in dust or fugitive emissions can have a negative impact on the local air quality (AQ) as well as the health of workers, nearby herders or local residents. The health effects include dust getting into eyes and mouth (workers, herders, residents), increased particles in the atmosphere, nuisance through surface soiling affecting local ecology (terrestrial and aquatic).

A description of the potential impacts and magnitude is provided below and summarised in Table 47.

8.1.2 Receptor sensitivity

The AOI for potential AQ impacts identified for the construction works is defined as 250 m[116] from the boundary of the Project site, ROW and the road used for delivery of materials and personnel to the site (up to 500 m from the site entrance / batching plant entrance). The sensitivity of nearby receptors within this AOI is summarised in Table 46.

Table 46: Summary of Project AQ receptor sensitivity

Receptors	Distance from the site	Sensitivity
Workers (at Site and along the OHTL and accommodation facility)	Within 250 m of the works	Medium
ABIS canal	Within 70 m of the works, is used as drinking water (Kirlishon community) and contains priority biodiversity features (PBF's[117]).	High
Road users (unsurfaced roads)	Outside 250 m buffer zone	Low
Road users (surfaced roads)	Outside 250 m buffer zone	Low
Herders	Outside 250 m buffer zone	Low
Nearby houses and communities (Farmer 01 property, Kirlishon, Kulchovadur)	Low (outside 250 m buffer zone, but may be impacted by vehicles travelling along the R78 up to 500 m from the site entrance/batching plant entrance)	Low

8.1.3 Construction phase

Activities during the construction phase which are likely cause AQ impacts include:

[116] 250 m is typically accepted distance from the source of impact where air quality impacts have dissipated to acceptable levels [United Kingdom Institute of Air Quality Management (UK's IAQM) Guidance on the Assessment of Dust from Demolition and Construction

[117] A full explanation of PBF's is provided in section 8.8. PBF's are considered to species of high conservation value that require additional consideration in the ESIA process under EBRD PRs.

- Construction dust from the removal of vegetation leading to exposure of bare soil[118] to the wind and increased dust emissions.
- Operation of construction vehicles (on internal unpaved roads), excavation of foundations and cement production for foundations during site preparation and clearance works and groundworks leading to fugitive dust emissions specifically PM_{10} and $PM_{2.5.}$
- Vehicle movements on site, the short OHTL ROW and along delivery routes and use of temporary generators leading to an increase in visible exhaust smoke, fugitive emission of oxides of nitrogen (NO_x), volatile organic compounds (VOCs) and other fumes and gases.

The soil quality assessment indicated high level of lead and some heavy metals in the soil. Risks to workers and contamination is addressed under occupational health and safety (section 8.10 below).

Construction dust - All temporary work areas are expected to be within the Project site or the 30 m ROW for the small section of OHTL to be constructed for the LILO connection. Air quality impacts from removal of vegetation, movement of construction vehicles, excavation and groundworks are expected to be contained to the direct AOI defined as 250 m from the boundary of the Site. There are no other planned developments identified to occur in the AOI during the construction period. The soil assessment indicated that the soil is fixed and weekly fixed sands with a vegetation cover that is less than 50% of the ground cover. This type of soil can have a high dust generating potential contributing to the potential for dust impacts on site.

Fugitive emissions - Vehicle emissions are expected to be low magnitude based on the relatively low number of vehicles on site. The magnitude may be slightly elevated for the receptors along the delivery route (up to 500 m from the site entrance and batching plant entrance) where delivery vehicles may pass close to the communities.

8.1.4 Operation phase

No operational emissions are anticipated from the Project operation (PV/BESS/OHTL) during normal operations. Project-dust and fugitive emissions (vehicles and plant equipment) will be infrequent based on the schedule of maintenance works required and the low number of personnel on site. General GIIP for operational phase dust and fugitive emissions management are outlined in the ESMP (Volume IV). Any abnormal dust or fugitive releases during operation are addressed under emergency preparedness and response (section 8.10).

8.1.5 Decommissioning phase

Key activities that could give rise to AQ impacts (dust and fugitive emissions) are:

- Demolition of plant, towers and electrical systems, removal of plant and electrical system materials from site, structural foundation removal; and decommissioning plant item movements.
- Decommissioning traffic movements (removal of equipment and transfer of personnel to and from the worksites).

[118] discussed in section 8.6

The receptors for AQ impacts will have the same sensitivity as for the construction phase. The magnitude of decommissioning AQ phase impacts will be similar (or less) to those generated during the construction phase and include dust generated from on-site vehicles and general dust associated with above ground and below ground removal of infrastructure and fugitive emission of oxides of nitrogen (NO_x), volatile organic compounds (VOCs) and other fumes and gases e.g., related to on-site generators. It will be necessary to confirm the nearest sensitive receptors based on a decommissioning phase impact assessment at the time of decommissioning to verify these assumptions.

8.1.6 Cumulative impacts

Although there is a short temporal overlap between the works at the neighbouring water pumping stations and the start of works at the main site, there is not considered to be an overlap in the air quality AOI for each project.

8.1.7 Summary of impact magnitude

Table 47 summarises the impact magnitude for the impacts identified above.

Table 47: Summary of magnitude - air quality

Activity	Intensity/ compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Construction Dust (site establishment, vehicles movements)	Medium	3 to 6 months	Within 250m of the Site boundary	Temporary during works only	High	Medium
Construction Fugitive exhaust emissions	Low	3 to 9 months	Within 250m of the Site boundary	Temporary during works only	High	Low
Decommissioning dust (site establishment, vehicles movements, cement batching)	Medium	3 to 9 months	Within 250m of the Site boundary	Temporary during works only	High	Medium
Decommissioning fugitive exhaust emissions	Low	3 to 6 months	Within 250m of the Site boundary	Temporary during works only	High	Low
Cumulative impacts	Low	3 to 6 months	Within 250m of the Site boundary /access road	Temporary during works only	High	Low

8.1.8 Mitigation, management and monitoring measures

Table 48 outlines the project specific mitigation and GIIP to prevent or minimise air quality impacts for each project phase.

Table 48: AQ mitigation and management

Project Phase	Requirements
Design/ Contract/ Procurement	- Require all contractors to have an area on site for shelter during dust events. - Maintain mandatory 70 m buffer zone between site fence line and canal edges.
Construction – Project specific	Develop Emissions Management Plan to include the following: - Construct new sections of road in accordance with site clearance and stockpile management requirements including ensuring any stockpiles are covered to minimise dust events. - Excavation, handling and transport of erodible materials shall be avoided under high wind conditions where practicable. - Use water (from sustainable source) or other control measures such as chemical bonding agent or aggregate to control dust. - Demarcate delivery road and access tracks at site and ensure all workers stick to demarcated areas. - No plant or equipment to be stored less than 250 m from the canal edge. - No onsite cement batching - use existing concrete batching plants in the local area for cement production or use pre-cast concrete blocks. - Erect worker shelter on site for protection in the event of a major dust event.
Construction – GIIP	- All workers to wear personal protective equipment (PPE). - Keep vehicle movements to a minimum. - Enforce speed limits and reduce vehicle movements (maximum of 10 km/h) for project vehicles on unsurfaced roads). - No bonfires or open burning of materials at the site. - Minimise amounts of material handling and avoid double handling to avoid transportation movements. - Ensure all vehicles carrying loose or potentially dusty material to or from the site are fully sheeted. - Ensure that vehicle engines and equipment on site are not left running unnecessarily. - Minimise movement of construction traffic around the site. - Where possible, use low sulphur fuels to reduce SO_2 emissions. - Do not run equipment unnecessarily. - Engines and exhaust systems should be maintained so that exhaust emissions do not breach statutory emission limits set for the vehicle/equipment type and mode of operation. - Following the SEP, inform nearby residents and road users on the timing and duration of works and key delivery periods.
Operation and maintenance	- All workers to wear personal protective equipment (PPE). - Keep vehicle movements to a minimum. - Enforce speed limits and reduce vehicle movements (maximum of 10 km/h) for project vehicles on unsurfaced roads). - Ensure that vehicle engines and equipment on site are not left running unnecessarily.
Decommissioning	- Same as construction phase (project specific and GIIP)
Monitoring	- Daily visual monitoring of dust episodes, soiling of vegetation, dust resuspension on the roads and dust clouds at work fronts. - Maintain logbook: record any exceptional incidents that cause dust, either on- or off-site, and the action taken to resolve the situation in the logbook. - Monitor implementation of GIIP for concrete batching at offsite batching plant locations (e.g., covered stockpiles, sealed hoppers) All observations and non-conformances to be managed through corrective action tracker and reviewed on a weekly basis.

Project Phase	Requirements
Compensation / Enhancement	- None identified

8.1.9 Residual significance

The magnitude of the impact is expected to reduce for all receptors including those within 250 m of temporary works sites (e.g., herders, site workers). Residual significance is highest for workers on site and potential dust impacts on the ecology and functioning of the ABIS canal. All other impacts are expected to be of minor significance or below.

Table 49: AQ residual significance

Adverse impacts	Magnitude (pre-mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Construction dust (site establishment, vehicles movements,)	Medium	i) High (workers and ABIS canal ii) Low (community, herders)	Low	Moderate (Neutral all other receptors)
Fugitive exhaust emissions	Low	Medium (all receptors: workers, ABIS canal, community, herders)	Low	Neutral
Decommissioning dust (infrastructure removal, vehicle movement, site restoration)	Medium	i) High (workers and ABIS canal ii) Low (community, herders)	Low	Moderate (Neutral all other receptors)
Decommissioning fugitive exhaust emissions (vehicle and plant exhaust emissions)	Low	Medium (all receptors: workers, ABIS canal, community, herders)	Low	Neutral

8.1.10 Data limitations and uncertainty

None identified.

8.2 Environmental Noise

8.2.1 Potential impacts

Increases in noise emissions can have an adverse impact on the health of any nearby herders and residents. The health effects include hearing impairment, sleep disturbance, interference with

speech communication, mental-health and performance effects, effects on residential behaviour and annoyance; and interference with intended activities.[119]

Noise effects on workers are addressed under occupational health and safety in section 8.10 below.

8.2.2 Receptor sensitivity

The AOI for noise impacts during the construction and decommissioning phases is defined as 250 m from the boundary of the site, either side of the OHTL centre line, and 250 m from the R78 used for delivery of vehicles from Alat city to the Project site.

The current noise baseline is low and strongly influenced by natural sources of sound, e.g., wind and animal or traffic noise. Spot check monitoring at key noise-sensitive receptor locations indicates baseline noise levels of between 35 and 40 dB(A) in the daytime. The baseline study did not indicate any permanent noise sensitive receptors in the AOI (250 m) i.e., receptors where people or operations are particularly susceptible to noise e.g., residential areas, places of worship, hospitals, or schools. It is possible that Farmer F01 andherders grazing neighbouring land, and workers residing at the Khamza one accommodation camp may have a greater susceptibility to increased noise generating activity from activity along the access roads and at site. The sensitivity of the identified receptors is summarised in Table 50.

Table 50: Project noise receptors

Receptors	Distance from the site	Sensitivity
Workers (at site and along the OHTL and accommodation facility)	Within 250 m of the works	Medium
Road users (unsurfaced roads)	Outside 250 m buffer zone	Low
Road users (surfaced roads)	Outside 250 m buffer zone	Low
Herders	Neighbouring	Medium
Nearby houses and communities (Farmer 01, Kirlishon, Kulchovdur)	Low (outside 250 m buffer zone, but may be impacted by vehicles travelling along the R78)	Low

8.2.3 Construction phase

The main noise generating activities during construction are:

- Site preparation works including piling and excavation works, assembly of Project components, road works, on-site traffic movements; and
- Delivery of materials and plant to the site and the arrival and departure of workers from each Workfront.

Site preparation works – The baseline environment does not have any significant noise source (except for road vehicles and animal noises) impacts are expected to be mildly disruptive meaning the noise can be heard for receptors within the AOI e.g. herders (250 m) and in the wider area, and may cause small changes in behaviour and/or attitude, but not to the extent that it will result in a change in the quality of life.

[119] WHO Guidelines for community noise

*Delivery of material*s – as above, due to the low noise background, increased vehicle deliveries are likely to result in a noticeable change in noise level but unlikely to cause any change in behaviour or attitude.

8.2.4 Operation phase

Operational noise impacts mainly arise from maintenance works during operation. These will be short-term and intermittent with major maintenance periods scheduled to occur approximately twice per year. Abnormal or emergency noise events will be short-term and temporary. Given the proximity of noise-sensitive receptors, operational noise impacts are not expected to be significant and are not considered further. General GIIP for operational phase noise management is outlined in the ESMP (ESIA Volume IV). Any operational phase noise grievances will be managed through the Project grievance mechanism as defined in the SEP (ESIA Volume VI).

8.2.5 Decommissioning phase

Decommissioning noise impacts will be similar to those generated during the construction phase. Key activities that could give rise to decommissioning noise impacts are:

- Demolition of plant, removal of PV and BESS systems, removal of plant and electrical system materials from site, structural foundation removal; and decommissioning plant item movements; and
- Decommissioning traffic movements (removal of equipment and transfer of personnel to and from the worksites).

The magnitude of impact from decommissioning works and traffic movements are classed as the same as for the construction phase.

8.2.6 Cumulative impacts

Noise impacts are expected to be contained to the direct AOI (250 m from the proposed works). There are no other planned developments in the AOI during the construction period. Cumulative noise impacts are not considered relevant.

8.2.7 Summary of impact magnitude

Table 51summarises the impact magnitude for the impacts identified above.

Table 51: Summary of magnitude – noise

Activity	Intensity	Duration	Extent	Reversibility	Likelihood	Magnitude
Site preparation works (construction and decommissioning)	order of 60 to 65 dB(A) 200m from the noise source during daylight only	3 to 6 months	Within 250m of the work activity	Temporary during works only	High	Medium
Delivery / Removal of materials	order of 60 to 65 dB(A) 200m from	1 to 3 months	Within 250m of the work	Temporary during	High	Low

(construction and decommissioning)	the noise source during daylight only		activity and along the main road	deliveries only		

8.2.8 Mitigation, management measures

Table 52 outlines the Project-specific and GIIP management and monitoring requirements to prevent or minimise noise impacts for each Project phase.

Table 52: Noise mitigation and management

Project phase	Mitigation and management measures
Design / Contract/ Procurement	- All equipment to ensure less than 85d(B) A at 1m from the equipment.
Construction – Project specific	- EPC contractor to supplement existing noise baseline with pre-construction baseline noise measurements at nearest residential receptor to the R78 for the Kirlishon and Kulchovdur communities, the R78 between the Kirlishon and Kulchovdur communities, batching plant, and community within the Khamza 1 pumping station. - No noisy or high noise activities to be undertaken outside normal working hours (7am to 6pm) without prior approval of the Project Company. - Locate all equipment and laydown area at least 250 m from any sensitive receptors (specifically farmer 01 and the ABIS canal) and within the project site. - No blasting without prior approval of the Project Company.
Construction – GIIP	- Position plant items as far as practically possible from sensitive receptors. - Use quietest work methods and plant items where practicable. - Equipment to be properly maintained and fitted with appropriate noise control at all times. - Avoid unnecessary revving of engines. - Vehicles are not permitted to idle with engines on. - Switch all equipment off when not in use. - Locate static plant (e.g., generators) to take advantage of any screening to break the line of sight from receptors. - Brief site operatives to keep noise to a minimum. - Following the SEP inform receptors when work will commence and any particular noisy works. - Wear PPE for noisy activities.
Operation	- Make sure the legal limits on noise exposure are not exceeded. - Give employees information, instruction and training.
Decommissioning	- Same as construction (project specific and GIIP)
Monitoring	- Spot check monitoring may be performed at sensitive sites when grievance arises. - Monitor grievance log for noise related complaints. - Conduct noise monitoring in the event of a noise complaint or evidence of exceedance of community noise guidelines values. All observations and non-conformances to be managed through corrective action tracker and reviewed on a weekly basis.
Enhancement	- None identified

8.2.9 Residual significance

Following the application of the mitigation and management measures outlined in Table 53, the magnitude of the impact is expected to reduce for all receptors and in particular those that may

fall within 250 m of temporary works sites (e.g. herders, site workers) (Table 53). All residual impacts are considered minor or less and therefore insignificant.

Table 53: Noise residual significance

Adverse impacts	Magnitude (pre-mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Construction site works (clearance, ground works, erection) (all locations)	Medium	Medium	Low	Minor
Construction traffic movements (all locations)	Low	Low	Low	Neutral
Decommissioning site works	Medium	Medium	Low	Minor
Decommissioning traffic movements (all locations)	Low	Low	Low	Neutral

8.2.10 Data limitations and uncertainty

None identified.

8.3 Solid Waste

8.3.1 Potential impacts

Solid waste will be generated during the construction, operation and decommissioning of the PV site, substation, OHTL, worker accommodation and supporting access roads. Typical waste streams (hazardous and non-hazardous) expected to be generated during the construction, operation and decommissioning works are summarised in Table 54 below.

Table 54: Typical waste streams expected to be generated during the construction, operation and decommissioning phases of the Project

Waste type (*hazardous)	Hazard Class (I, II, III, IV) [120]	Site (PV and BESS)	Overhead line	Worker accommodation (onsite)
Existing Cabling (may contain oil)	II	N/A	N/A	N/A
Waste Electrical and Electronic Equipment (PV Panels and batteries) *	I, II	✓	✓	N/A
Contaminated Soils*	N/A	✓	✓	N/A
Brickwork	III, V	✓	N/A	N/A
Concrete	III, V	✓	✓	N/A
Asbestos* [121]	I, II	N/A	✓	N/A
Steel	V	✓	✓	N/A
Copper	IV	✓	✓	N/A

[120] Hazards class is defined based on national classification standards as set out in the Resolution of Cabinet of Ministers of The Republic of Uzbekistan "On Approval of The Regulations on the Order of Development and Approval of Draft Environmental Standards" dated January 21, 2014. Class I – extremely hazardous waste, Class II – highly hazardous waste, Class III – moderately hazardous waste, Class IV – low-hazardous waste, Class V – inert waste.

[121] In accordance with EBRD PR3 and relevant international conventions on waste, asbestos is not permitted to be used and will be prohibited explicitly in relevant project contracts. It's use is not considered further.

Waste type (*hazardous)	Hazard Class (I, II, III, IV) [120]	Site (PV and BESS)	Overhead line	Worker accommodation (onsite)
Mercury*	I	N/A	N/A	N/A
General waste	N/A	✓	✓	✓
Timber	V	✓	✓	N/A
Soils and stones, topsoil	V	✓	✓	N/A
Temporary fencing, gates and troughs	N/A	N/A	✓	N/A
Topsoil, timber, brash, fence posts, wire etc.	N/A	N/A	N/A	N/A
Tarmac/made ground (rubble/hardcore/piling mats)	V	N/A	N/A	N/A
Batteries*	II, III	✓	✓	✓
Fluorescent tubes*	N/A	N/A	N/A	✓
Printer cartridges*	N/A	N/A	N/A	✓
Concrete washout	III, V	✓	✓	✓
Waste oils/ sludges*	I, II, III, IV	✓	✓	✓
Mastic Tubes	N/A	✓	✓	✓
Solvents*	I, III	✓	✓	✓
Paints*	N/A	✓	✓	✓
Aerosols*	N/A	✓	✓	✓
Used spill kits*	N/A	✓	✓	✓
Canteen waste, safety equipment	V	N/A	N/A	✓
Mixed metals	N/A	✓	✓	✓
Packaging waste	V	✓	✓	✓
Sanitary waste*	N/A	N/A	N/A	✓
Septic tank waste*	N/A	N/A	✓	✓
Plastics	IV	✓	✓	✓
Ceramics	III, V	✓	✓	✓
Paper/ cardboard	II, IV, V	✓	✓	✓
Glass	II	✓	✓	✓

8.3.2 Receptor sensitivity

The availability of suitable waste facilities in the AOI for transportation and disposal of general waste is generally good, however options for disposal of hazardous waste in accordance with GIIP may be less readily available. Regulated waste transportation and disposal providers for hazardous waste do exist within Uzbekistan at the provincial level, however there is limited capacity to manage this at the local level.

Recycling of PV panels in Uzbekistan is not possible at this time, in particular at high volumes. It is assumed for this ESIA that the availability of options for PV panel recycling within Uzbekistan will not be foreseen during the operational lifetime of the Project.

The sensitivity of different receptors to waste generated by the Project, including waste disposal facilities is provided in Table 55.

Table 55: Project waste receptors

Receptor	Sensitivity
General waste providers (transportation and disposal)	Low (available locally)
Hazardous waste providers (transportation and disposal)	Medium (available regionally)
PV Specialist waste recycling companies (transportation and disposal)	High (not available in country)
Workers and community	Medium
ABIS canal	Medium

8.3.3 Construction phase

During construction, activities with the potential to generate impacts relating to waste include:

- Inadequate handling, transfer and disposal of general waste leads to uncontrolled releases to land, air, groundwater leading to degradation and pollution of the receiving environment and potential fines and/or penalties under national regulations.
- Inadequate handling, transfer and disposal of hazardous waste (on site and from removal of existing OHTL) leads to uncontrolled releases to land, air, groundwater leading to degradation and pollution of the receiving environment and potential fines and/or penalties under national regulations.
- Poor handling and storage of wastes can lead to health impacts on workers and local community (instruction of pests etc.).

General waste management: During construction, the expected volumes of all general wastes (as identified in Table 54) generated at the Site is expected to be low. General waste will be segregated and stored on site in temporary storage locations for onward transportation and ultimately disposal at a facility within Uzbekistan. General waste (including non-hazardous construction waste) will be sent to a municipal landfill designated for general or construction waste or both following national standards for labelling, segregation, transportation and disposal. This landfill can be used to dispose of construction waste and some types of industrial waste rated at Hazard Class III and IV however this requires a special approval from a respective Centre for Sanitary and Epidemiological Supervision (CSES). A due diligence will be performed before use to confirm the activities at the waste disposal facility align with GIIP.

Hazardous waste management: Hazardous waste management: including oils and asbestos, can be treated in-country in accordance with GIIP principles for waste management. Available facilities for hazardous waste disposal are not available locally but can be transferred to regional facilities located in Bukhara as descried in 5.4.10.

Based on the anticipated waste streams, the waste volumes predicted to be generated and the short-term nature of the works, the magnitude of the impact from general waste is deemed to be Low.

For hazardous wastes, the magnitude of the impact is expected to be Medium, considering the availability of hazardous waste facilities that operate in alignment with GIIP will require the Project to transport waste to Bukhara or beyond.

8.3.4 Operation phase

During operation the key solid wastes generated by the Project will be waste from obsolete, malfunctional or damaged PV panels and batteries (required to be replaced on average every 10 years) as well as low levels of hazardous waste such as oils, solvents, paints, during maintenance works , as well as general waste.

General waste management: General hazardous waste and general waste will be generated in low volumes given the low number of operating personnel on site and the infrequent maintenance requirement.

Hazardous waste management: PV modules are generally considered specialist or hazardous waste and contain small amounts of environmentally toxic metals and elements (e.g., lead, selenium, cadmium) which, if not carefully disposed of, can result in environmental impacts. During maintenance works, it is expected that some electronic (PV) waste will be generated including low risk hazardous and non-hazardous wastes (see under decommissioning below). With regard to the PV panels, most parts of a solar module will be recycled, including the glass, semiconductor materials, ferrous and non-ferrous metals. Recycling can recover up to 90 % of the photovoltaic glass and also up to 95 % of the semiconductor material necessary for further production[122]. However, this recycling is not available in Uzbekistan at this time. PV wastes will be dealt with in accordance with the Masdar standard operating procedure for waste management and national regulations. The planned disposal of PV panels and batteries is expected to be by the Supplier.

8.3.5 Decommissioning phase

Waste generated during the decommissioning phase will include waste streams identified for the construction phase with the addition of significant volumes of metal waste and electronic waste (PV panels, batterie and cabling) arising from the decommissioning of the main structural and electrical components of the Project.

The minimum proper treatment for the end-of-life equipment is the removal of all fluids and the selective treatment of specific components including separation and removal of some key components, such as frames, glass, polymers, plastics and metals, and cables where possible for recycling or disposal.

The PV modules proposed for this Project are silicon based. For silicon-based modules, aluminium frames and junction boxes are typically dismantled manually at the beginning of the process. The module is subsequently crushed, and its several components are separated, allowing recovering up to 80% of the panel. Since a large quantity of these modules is composed of glass, it is not unusual for glass recyclers to be able to intervene in the recycling process. It is typical to return PV panels and batteries to the manufacturer for this process. Metal waste generated during the decommissioning phase can be routed to metal recycling facilities in Uzbekistan.

Following removal of the Project infrastructure, the site will be restored to the surrounding land use. This process often includes filling in foundations with gravel or clean fill and replacing topsoil

[122] https://www.recyclesolar.co.uk/

and restoring the contours of the landscape. A vegetation restoration plan will be developed for this purpose (see section 8.6)

8.3.6 Cumulative impacts

The area is not subject to a large number of industrial or construction projects which may place a cumulative strain on the waste infrastructure of the region. No cumulative waste impacts are anticipated.

8.3.7 Summary of impact magnitude

Table 56 summarises the impact magnitude for the impacts identified above.

Table 56: Summary of impact magnitude – waste

Activity	Duration	Intensity	Likelihood	Extent	Magnitude
General waste management (construction)	Medium	Medium	High	Direct AOI	Low
Hazardous waste management (construction and removal of existing OHTL)	Medium	Medium	High	Direct AOI	Medium
Health impacts workers and community (construction and decommissioning)	Medium	Medium	High	Direct AOI	Low
General waste management (decommissioning)	Medium	Medium	High	Direct AOI	Low
Disposal and recycling facilities for main structural and electrical components of the PV panels, OHTL and substation (decommissioning)	Medium	Medium	High	Direct AOI	Medium
Operational waste (PV panels, batteries and general waste from maintenance works)	Long (more than 25 years)	Low	High	Direct AOI	Medium
Decommissioning waste	Medium	Medium	High	Direct AOI	Medium

8.3.8 Mitigation, management measures

Table 57 outlines the Project-specific and GIIP mitigation and management measures to prevent or minimise waste impacts for each Project phase.

Table 57: Waste mitigation and management

Project phase	Mitigation and management measures
Design / Contract	- Select PV panel producers and battery supplier that can ensure the take-back and recycling of PV panels during the operation phase and end of life decommissioning. - Ensure selected PV modules and battery supplier contract includes all costs for returning and decommissioning of PV panels (intermittently during operation and end of life). - Prohibit the following materials in EPC Contract / Procurement Policy

Project phase	Mitigation and management measures
	○ Asbestos ○ PCB containing materials ○ lead based paints ○ pesticide, herbicides as defined under Stockholm convention - Consider offsite manufacture and design for disassembly to minimize resource use. - Require an asbestos survey of OHTL tower and conductors to confirm presence or absence of asbestos in insulation material. If asbestos conformed, develop an asbestos removal and management plan prior to the start of OHTL removal works).
Construction - Project Specific	- Develop construction site waste management plan. - Undertake detailed duty of care audit for proposed general waste, construction waste and hazardous waste facilities in Uzbekistan to confirm compliance with GIIP.
Construction - GIIP	- Avoid, minimise the generation of hazardous and non-hazardous waste materials as far as is practicable - Define and demarcate dedicated temporary waste collection site at the worksite. - Remove all waste on a regular basis to offsite disposal facilities. - Employ the waste hierarchy. - Where waste is hazardous explore reasonable alternatives for its environmentally sound disposal considering the limitation applicable to its transboundary movements - Apply GIIP for the handling, segregation, transportation and disposal of waste of offsite disposal including: - Use third party waste transfer and waste disposal contractors that are reputable and legitimate enterprises requiring licences by relevant regulatory authorities In Uzbekistan - Explore options for recycling based on the availability of handling facilities in the region. - Train workers on their rights regarding working with hazardous wastes (e.g., PPE) and the correct way to handle and dispose of waste.
Operation & Maintenance	- Recycle PV and battery waste streams (buyback / take back scheme)
Decommissioning	- Develop decommissioning waste management plan - Recycle PV and battery waste streams (buyback / take back scheme)
Enhancement	- None identified. - Targets for recycling or re-use of equipment
Monitoring	- Weekly and monthly waste generation volumes for construction wastes (segregated by waste stream) - Operational waste streams - Waste contracts with authorised waste disposal facilities - Monthly volume of waste generated (per type) All observations and non-conformances to be managed through corrective action tracker and reviewed on a weekly basis.

8.3.9 Residual significance

Following the application of the mitigation measures outlined in Table 57 the magnitude of the impact is expected to reduce for all receptors. The residual significance post mitigation is summarised in Table 58. The assessment has indicated that waste impacts from the construction

and decommissioning phase of the Project would not be significant. The biggest impact results from the disposal of the PV panels and other electronic waste which is classed as having a moderate significance.

Table 58: Waste residual significance

Impact and Effect	Magnitude (Pre-mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
General waste management (construction)	Low	Low	Low	Neutral
Hazardous waste management (construction)	Medium	Medium	Low	Minor
Health impacts workers and community	Low	Low	Low	Minor
General waste management (decommissioning)	Low	Low	Low	Neutral
Disposal and recycling facilities for main structural and electrical components of PV and batteries	Medium	High	Low	Moderate
Operational waste (general)	Medium	Low	Low	Neutral
Decommissioning waste (general)	Medium	Low	Low	Neutral

8.3.10 Data limitations and uncertainty

None identified.

8.4 Climate Change

8.4.1 Potential impacts

This section considers the potential impact of Project activities on climate change, as well as the potential impacts/risks climate change will have on the Project activities. The Task Force for Climate Resilience categorised climate related risks are typically categorised as:

- Transition risks (including market and technology shifts, policy and legal and reputational risks); and
- Physical risks.

Potential climate change impacts from the Project include:

- Increased GHG emissions from construction activities; and
- Clean, renewable energy avoiding consumption of higher GHG emitting alternatives. (positive impact)

The following climate change risks may have an impact on the Project (refer to Appendix III: ESIA Climate Change Risk Assessment, June 2023 for full description):

- Extreme heat
- Cyclones / storms
- Landslides
- Water stress and drought
- Increased windstorms

8.4.2 Receptor sensitivity

The main receptors for climate change risks at the Project level are the Project infrastructure itself and workers. Based on the climate change projections (as described in section 5.4.2 and Volume III: ESIA Technical Appendices, Climate Change Risk Assessment) and the duration of the operations phase which is scheduled up to 2050, all infrastructure is considered to have a low sensitivity to change.

Workers are assigned a high-risk sensitivity based on there being little to no capacity to avoid climate related events during the construction phase and their susceptibility increases into the operation phase as climate related events may increase in frequency, refer to Table 59.

Table 59: Project climate resilience receptors

Receptor	Sensitivity
Physical Infrastructure	Low
Workers	High

8.4.3 Construction phase

GHG emissions: GHG emissions during construction will be limited to carbon dioxide from vehicle exhaust emissions and the potential use of diesel generators on site. GHG emissions during operation will be limited to the exhaust emissions of personnel, maintenance and supply vehicles.

The annual estimate of GHG emissions, over the lifetime of the Project will be less than the IFC threshold value of significance of 25,000 tonnes of carbon dioxide equivalent (tCO2e) per year. [123] Therefore, the magnitude is considered Low.

Physical climate risks: Of particular relevance to the Project are physical risks to project infrastructure and health risks. Market and technology shifts, reputation and policy risks are not considered relevant for assessment in this ESIA. It is worth noting however, that the Project can be considered to have a positive impact on the market and technology shifts required to improve climate resilience as described in the needs case assessment in Section 3.1, which highlights the Project contribution to supporting the transition of the Uzbekistan energy sector to low carbon through the deployment of renewables and the need to improve the resilience power network.

Considering the climate risk projections outlined in the baseline (Section 5.4) the Project will be susceptible to climate related risks during the construction and operational lifetime of the asset (expected to be 25 years (2025 - 2050) and 2050 to 2075 (extended operation).

Climate risk screening[124] has identified the following potential events with the potential to result in an impact to the workforce and physical infrastructure. Risk projections potentially relevant to the construction (and operation and decommissioning phase) are:

- more frequent dust storms
- extreme rain events
- potential for prolonged periods of extreme heat during the summer months

The climate change risk assessment[125] has determined that these risks are medium magnitude.

8.4.4 Operation phase

The actual PV installation will not generate GHG emissions during operation, and the energy generated will avoid emissions that will otherwise be generated wholly or partly from more carbon intensive higher GHG emitting sources. Since the Project is a renewable energy generation project, its operation phase emissions are considered to displace emissions that will otherwise be sourced from other electricity generation technologies[126]. This is considered to have a positive impact on climate change.

Physical climate risks are deemed to be the same as for the construction phase, however the magnitude is lower as the number of works on site and the intensity of the impact is less.

[123] IFC Technical Guidance for Financial Institutions — Assessment of Greenhouse Gases IFC 2023
[124] Nur Bukhara climate change risk assessment, June 2023,
[125] Nur Bukhara climate change risk assessment, June 2023
[126] IFI Approach to GHG Accounting for Renewable Energy Projects (World Bank, 2015)

8.4.5 Summary of impact magnitude

Table 60 summarises the impact magnitude for the impacts identified above.

Table 60: Summary of impact magnitude – climate change

Activity	Duration	Intensity	Likelihood	Extent	Magnitude
Displace GHG emissions	Long-term	Medium	High	Global	Medium (positive)
GHG emissions - construction only	Medium	Medium	High	Global	Low
Physical climate risks (Infrastructure)	Medium	Medium	High	Direct AOI	Medium
Physical climate risk (workers)	Medium	Medium	High	Direct AOI	Medium
GHG emissions – operation	Long term	Low	Low	Global	Low

8.4.6 Mitigation, management measures

Table 61 outlines GIIP mitigation and feasible and cost-effective measures to prevent or minimise climate impacts.

Table 61: Climate resilience mitigation and management

Project phase	Mitigation and management measures
Design	- Design for climate projections up to 2085. - Consider need to reinforce the structures or higher design standards (stronger winds, higher temperatures). - Design the access road to consider short-term, extreme weather events (e.g., support infiltration). - Consider concrete-sided buildings instead of metal. - Design site drainage to account for increased or short-term extreme precipitation patterns. - Design operation and maintenance regime assuming increased and extreme dust storms. - Specify more effective cooling for substations and transformers, including retrofitting measures, improved shading, and choice of cooler locations / shading where possible around the substation and the BESS site.
Construction - Project specific	- Identify shelter locations for workers in the event of a dust storm. - Prohibit work in wind conditions more than 15 km/hr. - Ensure sufficient supply of potable water at the work fronts (>3.5 L per worker per day). - Ensure sufficient shelter/shade during summer months. - Provide extra rest periods for workers when temperatures exceed 35 oC. - Change the shift hours in line with the cooler hours. - Ensure workers are not penalised for taking extra rest breaks during periods of extreme heat. - Erect temporary shade at all work fronts for all workers.
Construction – GIIP	- Consider climate risks in work risk assessments. - Address climate risk in worker induction. - Address climate risks (dust/extreme heat) in emergency preparedness and response planning (EPRP).
Operation and Maintenance	- Consider climate risks in work risk assessments. - Address climate risk in worker induction.

Project phase	Mitigation and management measures
	- Address climate risks (dust/extreme heat) in emergency preparedness and response planning (EPRP).
Decommissioning	- Identify shelter locations for workers in the event of a dust storm. - Prohibit work in wind conditions more than 15 km/hr. - Ensure sufficient supply of potable water at the work fronts (>3.5 L per worker per day). - Ensure sufficient shelter/shade during summer months. - Provide extra rest periods for workers when temperatures exceed 35 oC. - Ensure workers are not penalised for taking extra rest breaks during periods of extreme heat.
Enhancement / opportunities	- Planting for shade around the site and Project infrastructure (e.g., BESS structures, substation, PV site boundary.
Monitoring	- Establish an early warning system for wind and extreme heat events through continuous weather monitoring.

8.4.7 Residual significance

Following the application of the mitigation measures outlined in Table 61 the magnitude of the impact is expected to reduce for all receptors. The residual significance post mitigation is summarised in Table 62. The assessment has indicated that climate related impacts due to the construction, operation and decommissioning phase of each Project would not be significant.

Table 62: Climate resilience residual significance

Adverse	Magnitude (pre-mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
GHG emissions	Low	High	Low	Minor
Increased wind speeds (infrastructure)	Medium	Low	Low	Neutral
Increasing temperature (infrastructure)	Medium	Low	Low	Neutral
Extreme rain events (infrastructure)	Medium	Low	Low	Neutral
Climate related events (worker health)	Medium	High	Low	Moderate

8.4.8 Data limitations and uncertainty

None identified.

8.5 Water resource use, wastewater and water quality

8.5.1 Potential impacts

Water use, in general, can have a negative impact on water availability and water quality (surface and groundwater). The construction of the Project has the potential to compete with other water resources. For this Project, water will be sourced from the municipal water supply and delivered to site. In addition, unplanned wastewater discharge at site can lead to contamination of existing water resources (groundwater or surface water).A description of the potential impacts and magnitude is provided below and summarised in Table 66.

8.5.2 Receptor sensitivity

The groundwater is understood to be predominantly connected to the ABIS canal and at more than 15m depth. The likelihood that groundwater will be affected by construction works is low. Furthermore, groundwater is generally not used for drinking water (potable water boreholes are not known to be used in the area) with most people connected to the mains supply or abstracting water informally from the ABIS canal.

Despite the general scarceness of water in this region, considering the recent upgrades and capacity expansion to the Alat district water supply system, the municipal water supply is considered to have adequate capacity to meet the low to moderate needs of the Project and the sensitivity is therefore considered to be Low. The nearest water distribution centre (WDC) is the Ikkidakha WDC with a capacity of 50,000 L per day, the Project will use between 9 and 16% of that (considering a range of 4500 L to 8000 L per day during construction, as described in Table 64 belowFollowing the recent upgrades, the Ikkidakha (WDC) operates with a 50% reserve capacity (based on public information).

The quality of the water in the ABIS canal is not suitable for drinking water (which it is sometimes used for) but it is used by a number of people for fishing and other activities, and as such the sensitivity is considered High.

Table 63: Project water resource and water quality sensitivity

Receptor	Sensitivity
Groundwater (more than 15 m in depth)	Low
Municipal water supply (originating from the Amu Bukhara canal)	Low (water use)
ABIS canal (used by Jiydali settlement of Kirlishon and communities)	High (water quality)

8.5.3 Construction phase

Project activities during construction and commissioning which are likely to impact the availability of water resources for competing water users or lead to contamination of sensitive water receptors include:

- Additional water use during construction works leading to increased pressure of water availability and supply via the district water system;
- General construction works lead to direct contamination of groundwater from sanitary waste, construction wastewater and contaminated run-off leading to pollution of

groundwater (in particular during extreme precipitation events) or nearby surface water courses[127]; and

- Changes to the surface water drainage regime[128].

Water use: The Project will require water for construction activities and domestic use operations, as described in Table 64. Potable water, water for the accommodation camp (if needed) and construction water will be sourced from the municipal water supply and tankered to site. During construction, the main water use is connected with cement manufacture, however this will be sourced via a third-party provider. Water for cement manufacturer will be the responsibility of an existing offsite facility (the nearest existing concrete batching plant is ~2km from the Project site).

On-site construction water needs are estimated between 4,000 L and 5,000 L per day (as described in Table 65). All water procured will be from nearby Water Distribution Centre and logged in a daily water log to monitor consumption at site. Considering one small to medium sized water tanker onsite may hold between 8,000 L and 10,000 L, the daily water needs are considered to be Low.

Table 64: Project water requirements for construction phase

Phase	Task / Sub-task		Water quantity	Unit	Water quantity (m3/Year)
Construction	Human consumption	Potable water	3	L / person / day	296
		Non-potable water / Sewage water	27	L / person / day	2,661
	Construction activities	Dust mitigation	3,000	L / km road / day	10,496
		Soil compaction	15	L / m road /day	263
		Concrete curing	8,000	L / day	1,460
		Cleaning machinery	500	L / construction machine / day	1,916
Total Construction Phase (m3/year)					**17,092**
Water use assumptions Construction Phase:					
Construction duration (months) (conservative)					19
Concrete curing duration (months) (conservative)					6
Number of daily workers (average)					270

Wastewater discharges: The AOI for the construction works considers the direct site plus a 250 m buffer around the site for the assessment of wastewater discharges. The baseline assessment identified groundwater and the ABIS canal to be within the defined AOI. The drainage channels to the west of the site are outside the AOI at a distance of approximately one kilometre from the Site.

[127] Leaks and spill and general contamination of soils is addressed in section 7.6.

[128] Changes to surface water run-off which may lead to increased erosion or increased sedimentation of surface water features in the indirect AOI (as a result of increased dust storms) are addressed in section 8.6.

Considering the frequency of extreme rain events, the short-term nature of the construction works, the volumes of liquids used during the construction process on site (mainly fuel, oils., greases etc.) and the localised extent of the potentially contaminated run off, it is possible that there will be a detectable impact to groundwater resources or to the ABIS canal. However, the impact is deemed unlikely to permanently change the groundwater pr surface water quality or lead to exceedances in current groundwater or surface water quality levels. Even in the worst-case scenario of wet season construction, the effects are still highly localised and temporary. The Project is also required to maintain a mandatory 70 buffer between the edge of the ABIS canal and the fence line. The overall impact magnitude is therefore considered to be Low.

Septic tanks of 2,500 litres will treat sewage water during construction and operation, and sewage waste will be collected for offsite transport and disposal at municipal wastewater treatment plants using regulated disposal companies. Estimated volumes of sanitary wastewater are considered to be low during construction with a peak during the earthworks and civils works phase.

8.5.4 Operation phase

Water use: Water use during the operations phase is very low primarily due to the planned dry-cleaning method for PV panels and the limited [10] operational staff on site. Based on the projected water consumption volumes, the Project does not require long-term significant water storage or a dedicated water borehole and water will be tankered to site from the municipal water source for potable and domestic use. The overall magnitude is considered to be Low.

Table 65: Project water requirements for operation phase

Phase	**Task / Sub-task**		**Water quantity**	**Unit**	**Water quantity (m3/Year)**
Operation (O&M)	Human consumption	Potable water	3	L / person / day	11
		Non-potable water / Sewage water	27	L / person / day	99
	PV Module cleaning	Dry cleaning	N/A	L / MWp / cleaning	N/A
Total Operation & Maintenance Phase (m^3/year)					**110**
Assumptions O&M Phase:					
Number of daily workers (average)					10

Wastewater discharges: The potential for untreated run-off of contaminated or potentially contaminated water during maintenance works to groundwater or the adjacent ABIS canal has been scoped out (Scoping report March 2023), noting that most maintenance works will be short-term, self-contained and operational procedures require maintenance works to remove all wastes (including liquid wastes) off-site for disposal in accordance with the operational waste management system. No water is required for PV cell cleaning and therefore no run-off is expected. A spills prevention plan will be in place for emergency scenarios, and this is elaborated further in section 8.6.

Changes to drainage regime: During operation, the drainage system is proposed to be designed to ensure no contaminated run-off can be routed to existing surface water features or discharge to

groundwater. Stormwater will be managed through a stormwater drainage system and management plan, and surface run-off may be discharged through sediment traps and in this case, erosion protection measures will be included as necessary. There will be no direct discharges to surface water or groundwater features during the operation phase.

8.5.5 Decommissioning phase

During decommissioning, water use is assumed to low and similar to the water requirements required for the construction phase. A detailed decommissioning water use balance will be prepared at the start of the works and assessed against the water availability at the time.

8.5.6 Cumulative impacts

Water use is relatively low and minimal discharges will be generated from the construction works. Combined effects as a result of other project activities in the vicinity are not expected to result in any pressures on local water resources that will result in an adverse environmental impact. We also note that the modernisation works at the Khamza 1 and 2 pumping stations, are expected to be complete in 2023/2024 before major works are required on this Project.

8.5.7 Summary of impact magnitude

Table 66 details the impact magnitude for the impacts identified above.

Table 66: Summary of magnitude – water use and wastewater

Activity	Intensity/ compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Water use (construction and decommissioning)	Medium	3 to 6 months	Indirect AOI (municipal water supply)	Temporary during works only	Intermittent (during works only)	Medium
Wastewater discharges (construction and decommissioning)	Medium	3 to 9 months	Within 250m of the Site boundary	Temporary during works only	Intermittent (during works only)	Medium
Wastewater discharges (sanitary wastewater) (construction and decommissioning)	Medium	12 to 16 months	Indirect AOI	Temporary during works only	Intermittent (during works only)	Medium

8.5.8 Mitigation, management measures

Table 67 below outlines the Project specific and GIIP management and monitoring measures to prevent or minimise water resource and wastewater impacts for each Project phase.

Table 67: Water use and water quality mitigation and management

Project phase	Mitigation and management measures
Design / Procurement	- Prohibit groundwater for potable or construction related purposes. - Water use from the canal only if assessed and permitted by the ABIS Canal Committee. - Include in the design the mandatory 70 m buffer between the site fence line and the ABIS canal edge. - Sanitary waste to be collected in portable latrines or septic tank and wastewater to be collected for disposal off site in municipal wastewater treatment facility (under licence). - Portable latrines or septic tanks to be installed at least 250 m away from the canal edge, with leak prevention and detection measures. - Drinking/potable water and construction water to be sourced from municipal supply and tankered to site (under permit). - Undertake groundwork to ensure appropriate site drainage (avoiding risk of contaminated run off). - Design measures for construction and operations will include adequate stormwater pollution prevention planning (SPPP), and incorporation of erosion and sediment control measure.
Construction - Project Specific	- Drinking water at the construction work front to be provided at drinking water stations (equating to at least 3 Litres per day, per worker). - All cement to be delivered to site pre-mixed or pre-cast from third parties with approved water use licences. - No storage or laydown areas within 150 m of the ABIS canal (mandatory 70 m buffer). - No direct discharge of contaminated water or potentially contaminated water to the ground or canal without prior treatment.
Construction – GIIP	- Construction ESMS will include stormwater pollution prevention planning (SPPP) monitoring and management measures. - Construction ESMS will include a Spill Response Plan (may be part of the EPRP) and include appropriate training and requirements for spill prevention and cleanup equipment including: o Use barriers (e.g., drip trays) to minimise impacts from spills or other potential leaks. o All chemicals, fuels, and oils are stored at the construction camps and laydown area to be in designated areas in a secure and bunded facility. o No herbicide uses. o Do not refuel except at a dedicated refuelling area. o All concrete washout to take place at designated concrete washout area only. o All cement trucks must return to the batching facility or a dedicated wash-out facility to perform cement washout. o Works with hazardous liquids must be performed over an area of hardstanding to avoid seepage to groundwater in the event of a spill.
Operation and Maintenance	- General operational management requirements concerning good housekeeping during maintenance works and waste management and spill management provisions must be implemented. - Operational ESMS will include SPPP monitoring and management measures.
Decommissioning	- As per construction phase.
Enhancement	- If any water supplies are developed to support the Project, these could be made available to the local community.

Project phase	Mitigation and management measures
	- Water purification tablets or purification systems can be provided to Jiydali settlement of Kirlishon.
Monitoring (KPIs)	- Weekly monitoring to ensure that SPPP measures have maintained integrity and efficacy of stormwater drainage system (more frequently during periods of bad weather). - Volume of construction water tankered to site. - Volume of potable water delivered to site. - No impact on water quality in ABIS canal - Number of reported spills (zero or downward trend to be maintained) - Number of reported incidents of concrete washout in undesignated area (zero) - No unauthorised release of contaminated or potentially contaminated water to ABIS canal or ground (zero) No monitoring required for the operation phase. All observations and non-conformances to be managed through corrective action tracker and reviewed on a weekly basis.

8.5.9 Residual significance

Following the application of the design mitigation measures as outlined in Table 67, (including avoiding using water from the ABIS canal, the use of dry-cleaning PV technology, and construction setbacks from the edge of the canal) the Project has avoided many significant impacts on the ABIS canal, and municipal supply system. The residual significance post-mitigation is summarised in Table 68. The assessment has indicated that the significance of impacts on water resource availability and groundwater quality would be neutral and for impact on water quality of the ABIS canal to be minor. Impacts on water resources is overall considered insignificant.

Table 68: Water use and water quality residual significance

Activity	Magnitude (pre mitigation)	Sensitivity	Magnitude (post mitigation)	Significance
Water quality (ABIS canal) - construction	Medium	High	Low	Moderate
Water quality (groundwater) - construction	Medium	Low	Low	Neutral
Water resource use (construction)	Medium	Low	Low	Neutral
Water quality – ABIS canal decommissioning	Medium	High	Low	Moderate
Water quality (groundwater) - construction	Medium	Low	Low	Neutral
Water resource use - decommissioning	Medium	Low	Low	Neutral

8.5.10 Data limitations and uncertainty

None identified.

8.6 Soils

8.6.1 Potential impacts

Locations for developing solar PV projects in Uzbekistan are typically desert regions and communal grazing pastures which experience high levels of land degradation, soil erosion and dust events. These locations are already under increased stress due to climate change, but even at the local level, minor land clearance (legal and illegal) can significantly impact the soil structure and erosion potential, leading to increasingly frequent localised dust events, significantly affecting grazing potential.

8.6.2 Receptor sensitivity

The vegetation has essential importance for sand fixation and to combat desertification. Where removed the semi-fixed and fixed sands can be under severe pressure from desertification. The sensitivity of soils to erosion is considered to be high based on the finally balanced relationship between the habitats and soil structure and subsequent capacity to absorb any changes as summarised in Table 69.

Table 69: Project soil receptors

Receptor	Sensitivity
Sandy Soils	High

8.6.3 Construction phase

During construction of the PV foundations, tower foundations, access tracks and the temporary laydown area and accommodation facility, impacts may include:

- Increased soil erosion (desertification) due to permanent removal of vegetation and topsoil and compaction of soils from increased use of heavy machinery, off-road vehicle movements and storage of construction materials; and
- Contamination of soils from construction activities at all locations including storage of hazardous materials, spills of oils, refuelling activities, use of chemicals, poor waste management.

Consideration of the deterioration of worker heath in particular during foundation excavation works due to the naturally elevated levels of heavy metals in the soils (lead, Cu, Zn, Ni, Cr) is addressed under occupational health and safety (Section 8.10).

8.6.3.1 Increased soil erosion

The soil in this area is typical of a natural sandy desert habitat consisting predominantly of fixed and semi-fixed sands, with pockets of saline land and low organic matter and nutrient content. The vegetation characteristic of this type of habitat is principally slow-growing shrubs and trees. The shrubs and trees play an important role in the stabilisation of the sandy desert as evidenced in areas where there is less vegetation cover. The shrubs and trees are essential for retaining the fixed structure of the sandy soils that dominate the majority of the Project site.

Removal or compaction of this topsoil layer can have permanent consequences for habitat in the temporary disturbed area leading to unfixed sands and increasing potential for erosion and the phenomenon known as “moving sands”. The site preparation works, and installation of the different components will require the removal of all vegetation in the direct impact area leading to increased erosion potential. The likelihood of the disturbed area naturally returning to its original state is low without intervention.

8.6.3.2 Contamination of soils

Storage of hazardous materials and general construction woks at the site have the potential to result in spills and leaks that may contaminate the soil. Examples include:

- Hydraulic oil leaks from heavy plant machinery;
- Small spills when undertaking mobile refuelling on the site; and
- Spills of hazardous materials during transit.

The spills will be short-term and contained to the direct impact area, but depending on the source of the spill, the volume could be significant.

8.6.4 Operation phase

No operational phase impacts are anticipated on soils and this has been scoped out from further assessment. All activities will be in areas that have been previously disturbed and are now under restoration program or covered in hardstanding. Areas where the potential for impact on soils in the event of a spill e.g. in substation area or around the BESS will be covered in hardstanding and key contaminants located in bunded areas.

8.6.5 Decommissioning phase

Decommissioning impacts are assumed to be the same a construction phase impact with the potential for some previously restored area to be stripped from vegetation again. A vegetation restoration plan will be implemented for restoration of the project area (see section 8.8) which will restore the soil to its original condition or better.

8.6.6 Cumulative impacts

No cumulative impacts are anticipated.

8.6.7 Summary of impact magnitude

Table 70 details the impact magnitude for the impacts identified above.

Table 70: Summary of magnitude – water use and wastewater

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Increased soil erosion	Medium	Long-term	Direct AOI	Permanent	High	Medium
Contamination of soils	Medium	Short term	Direct AOI	Temporary during works only	Low / intermittent	Low

8.6.8 Mitigation, management measures

Table 71 describes the Project specific mitigation and GIIP to prevent or minimise soil impacts for each Project phase.

Table 71: Soils mitigation and management

Project phase	Mitigation and management measures
Design	- Avoid total removal of vegetation (see biodiversity section) of the whole site where possible e.g., around the edges of the site and around the substation and BESS site as per Owners requirements - Grade temporary access roads so that their slope is not too large to avoid the build-up of fast-running run-off water during extreme precipitation events. - Adopt tension stringing techniques to avoid impacts on habitat between the towers and stringing points. - Pre-construction tree survey and seed collection to support no net loss but also provide options for vegetation rehabilitation on the site (see biodiversity section). - Seed collection (see biodiversity section). - Include erosion protection and prevention measures into the design.
Construction - Project Specific	- Site Mobilization Plan to include erosion control procedure outlining measures included in this row and Construction GIIP below for implementation at site. - Confine traffic movement to designated routes. - Immediately restore the topsoil and vegetative cover using seeded restoration techniques for all temporarily disturbed areas. - Develop a Vegetation Rehabilitation and Restoration Plan (part of the biodiversity management plan, see section 8.8) including specific measures to rehabilitate and restore temporarily impacted areas around the project infrastructure. Measures should include point below and constriction GIIP (next row). - For any area impacted by compaction, rehabilitate the compacted area to support the return of the impacted area to the original state as quickly as possible following completion of the works. This may require aeration of the topsoil, enrichment of the topsoil or reintroduction of selected species and shrubs. Do not rely on natural rehabilitation.
Construction – GIIP	- Reflect natural gradient and relief when reinstating soils. - When stripping, stockpiling or placing soil, do so in the driest condition possible and use tracked equipment where possible to reduce compaction. - Keep soil storage periods as short as possible. - Clearly define topsoil and sub-soil stockpiles of different soil materials for reuse of topsoil. - Use earthmoving plant that is appropriate to the size of the site, the volume of soil to be stripped and haul distances. - Topsoil will normally be stripped to a thickness defined by depth below the surface and a distinct colour change. - Define a designated area of storage of hazardous materials and ensure secondary containment (bunding) to contain any spills and adequate security. - Restrict access to hazardous materials. - Adopt GIIP for management for pollution prevention from using machines and equipment, refuelling, storage and handling of hazardous materials and management of wastes including: o Perform hazard risk assessment for different spill and release scenarios for all activities (based on information in material safety data sheets (MSDS); o Training of operators on release prevention, including drills

Project phase	Mitigation and management measures
	○ Implementation of inspection program for hazardous materials storage ○ Secondary containment, segregation of certain HAZMAT during storage (capable of containing the larger of 110 percent of the largest tank or 25% percent of the combined tank volumes in areas with above-ground tanks with a total storage volume equal or greater than 1,000 liters); ○ Specific PPE and training to relevant workers on the risk and management measures; ○ Defined response procedures (e.g., in emergency preparedness and response plan); and ○ Monitoring and record keeping, including inspections and audits. - Designate a central maintenance and refuelling area on site located on hardstanding. - For mobile refuelling or maintenance ensure a drip tray is used at all times. - Ensure emergency procedures in place for accidental spills of hazardous materials are outlined in the Emergency Preparedness and Response Plan. - Spill kits to be located on Site at all work fronts and a spill kit in all heavy plant machinery. - Train workers on spill management and hazardous materials management in induction and via toolbox talks.
Operation	- Develop a reinstatement and restoration plan as part of the operational ESMS (linked also with the no-net loss plan, see section 8.8.8) - Where possible, seek to return low level shrubs and grasses to areas around the panels to help fix the sands (linked also with the no-net loss plan). - Undertake supplementary watering to ensure the effectiveness of the rehabilitation or replanting works (linked also with the no-net loss plan). - Include in Operational ESMS erosion control plan to ensure erosion risks are managed for the duration of the operation phase.
Decommissioning	- Develop vegetation rehabilitation and restoration plan (as part of the biodiversity management plan) for whole site. - As for construction.
Enhancement	- Include swales and sand/soil contouring measures to prevent erosion and shifting sands.
Monitoring	- Five-year aftercare and monitoring program (as part of the oESMS) to ensure soil and associated vegetation cover is returned to its original state after construction (for temporary disturbed area). - Five-year aftercare and monitoring program (as part of the oESMS) to ensure soil and associated vegetation cover is returned to its original state after decommissioning (for return of disturbed area reclaimed following decommissioning. All observations and non-conformances to be managed through corrective action tracker and reviewed on a weekly basis.

8.6.9 Residual significance

Residual significance is summarised in Table 72.

Table 72: Soil residual significance

Adverse	Magnitude (pre-mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)

Soil erosion	Medium	High	Low	Moderate
Soil contamination	Low	Medium	Low	Minor

8.6.10 Data limitations and uncertainty

None identified.

8.7 Traffic and transportation

8.7.1 Potential impacts

Increases in traffic movements and the transportation of equipment and workers can have a negative effect on the local transportation network as well as the health and safety of workers and local residents. The health effects include dust getting into the eyes and mouths of workers and residents, increased dust particles in the atmosphere, nuisance through surface soiling affecting local ecology, nearby agricultural areas and/or passing grazing animals.

8.7.2 Receptor sensitivity

The AOI for traffic and transportation impacts is considered to be within 250 m of the road from Alat City to the Project site. There are a number of small villages along the route from Alat City to the Project site. In most cases, these villages are set back from the road and are not anticipated to be directly impacted by the Project traffic although the residents may be at risk during periods of increased traffic.

The local community workers at the Khamza 1 pumping station and the Krilishon mahalla housing located within the Khamza 1 area also fall within this AOI and are considered most vulnerable as they are likely to experience more concentrated impacts associated with movement of large delivery vehicles and longer-term impacts associated with increased volume of construction traffic, in particular vehicles travelling to and from the batching plant to the Site. There are also some transient receptors in the AOI that may also be considered vulnerable. Herders often use the roads around the Site to herd cattle between grazing areas and residents of nearby villages may cross the road to access to ABIS canal.

In addition to human receptors, the road infrastructure itself, in particular between Alat city and the Site, is considered vulnerable to changes in road quality as a result of the increase in Project vehicles.

The road between Bukhara and Alat City and further afield are considered to be major trunk roads (as described in section 5.4.12) and not within the Project AOI. The sensitivity rating of receptors in the AOI are summarised in Table 73 below.

Table 73: Project traffic receptors

Receptor	**Sensitivity**
Road (R78) infrastructure (surfaced and unsurfaced roads) (Alat City to the Project site)	Medium
Road users (herders, local villagers)	Medium

8.7.3 Construction phase

Activities during the construction phase which may lead to traffic related impacts for the Project include:

- Additional traffic on the single carriageway R78 (including heavy goods vehicles) from Alat City to the Project site leading to impacts on road users and traffic flow; and
- Increased vehicle movements on all roads leading to deterioration of road infrastructure.

Dust and noise impacts on receptors from traffic movements are addressed in section 8.1 air quality and 8.2 noise.

8.7.3.1 Impact upon Road Users and Traffic Flow

Additional traffic movements: The regional road R78 from Alat City to the north of the Project site will be used to transport Project components to (or from) the site during construction and decommissioning. The route passes through nearby local communities before reaching a major trunk road. It is not expected that significant impacts will occur due to the size of the Project components and the fact that the road is a main road and communities along the route will be accustomed to traffic.

Based on baseline data about the traffic flow along the R78 from Alat City to the Project site, the traffic volumes and flow in the area is low, in particular after the Khamza 1 pumping station. Based on the assumption of up to 15 trucks per day to and from the site during cement works and equipment delivery (months 3 to 6), the Project could add up to 30 truck movements per day during the early stages of equipment delivery and cement works. This would taper off during the PV module installation works and taper off even further during commissioning works.

There may also be up to eight heavy goods vehicle (HGV) movements connected with the delivery of the four 40 ft BESS containers, and up to four vehicle movements connected with the delivery of the transformers and cranes. The increase in traffic will be for the duration of the construction period, although movements will be intermittent (in relation to large delivery vehicles) and short-term (considering the duration of the delivery phase). The use of the potential batching plant to the east of the Kirlishon mahalla housing can help to significantly reduce the number of receptor impacts. In addition, the Project is not expected to route traffic south along the R&* which runs parallel to the western boundary of the site, instead ensuring that all project vehicles enter and exit the site at the main entrance. This will further reduce traffic movements on roads around the site and confine movements to specific sections of the road which will help with traffic management.

Figure 93: Example of vehicle delivery solar panels

Figure 94: Example of delivery of BESS containers

x

Figure 95: Example of vehicle delivering transformer

Deterioration of transportation Infrastructure – There may be some deterioration of road surfacing on the R78 due to the increase in vehicle movements, in particular along the section between the batching plant and the site where the most vehicle movement will be experienced. Although this will be short term and intermittent, the road is not designed for a concentration of HGV vehicle movements in this area.

8.7.4 Operation phase

During the operations phase only very low levels of traffic would be generated by the Project with trips being generated by the traffic movements generated by the small team of operational staff (10-15 persons) at the site, and trips connected with the maintenance and upkeep of PV modules, batteries, OHTL and substation which are scheduled to occur approximately twice per year. For these reasons, operational impacts are scoped out from further assessment.

8.7.5 Decommissioning phase

During the decommissioning phase, a similar volume of traffic as generated during the construction phase will be generated to bring workers to and from the site, but also to remove the dismantled Project infrastructure. The exact nature of the impacts will be assessed at the time based on the specific decommissioning approach. The impacts of Project decommissioning are expected to be less than or equal to those resulting from Project construction.

8.7.6 Cumulative impacts

No transportation related cumulative impacts are foreseen with regard to delivery of core equipment. There may be some cumulative impacts related to the construction phase due to overlap between finalizing of the Khamza 1 and II pumping station refurbishment works and civil works and transportation of equipment phase of the Project.

8.7.7 Summary of impact magnitude

Table 74 details the impact magnitude for the impacts identified above.

Table 74: Summary of magnitude – water use and wastewater

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Impact upon Road Users and Traffic Flow	Medium	3- 9 months (infrequent)	Indirect AOI (from Alat city to Site)	Temporary during works only	High	Medium
Impact upon Route Infrastructure	Medium	12 to 16 months	Road from Alat city	Permanent	High	Medium

8.7.8 Mitigation, management and monitoring measures

Table 75 outlines Project specific and GIIP management and mitigation measures to prevent or minimise traffic and transportation impacts for each Project phase.

Table 75: Traffic and transportation mitigation and management

Project phase	Mitigation and management measures
Design / Contract	- Design laydown area and delivery approach to minimise vehicle stopping outside the site access. - Perform a road condition assessment prior to and following the 'core construction period' to assess damage to road infrastructure that can be attributed to project construction. - Include clause in the EPC contract that that any damage to road (wear and tear over the construction period) must be repaired and 'made good'. - EPC to confirm delivery routes and conduct condition surveys of routes to be used to the Project site.
Construction - Project Specific	- Prepare a traffic and transportation management plan - Demarcate delivery road and access tracks across the site and ensure all workers stick to demarcated areas. - CLO to engage local community to inform of start of construction works and timings for large vehicle deliveries (e.g., BESS containers, cranes, transformers) - Install appropriate signage to inform local communities and road users of site access points. - No night-time driving along unsurfaced roads. - All refuelling of delivery vehicles to be undertaken in Alat City. - Require all drivers to undergo a driver's induction and sign the drivers code of conduct. - Maximum of 40 km/h on section of road between Khamza 1 pumping station and site.
Construction – GIIP [129]	- Enforce speed limits and reduce vehicle movements (maximum of 20 km/h) for project vehicles on unsurfaced roads and within the site. - Minimise amounts of material handling and avoid double handling to avoid transportation movements. - Implement dust suppression measures.

[129] GIIP for air managing air quality impacts can be referred to in https://www.rbkc.gov.uk/pdf/Document%2012%20-%20BRE%20-%20Control%20of%20Dust%20from%20Construction%20and%20Demolition%20Activities.pdf ii) IFC EHS Guidelines General

Project phase	Mitigation and management measures
	- Keep vehicle movements to a minimum. - Comply with weight limit restrictions on all roads. - Ensure escorts, flag persons and other safety measures are employed where necessary (e.g., entering and exiting the site / batching plant) - Coordinate with all necessary authorities. - Include measures to respond to traffic incidents in the EPRP. - Evidence that all drivers can demonstrate required competencies for the vehicle they are driving and have signed a driver's code of conduct.
Operation and Maintenance	- Speed limits
Decommissioning	- Decommissioning phase route assessment - As per construction and project specific and construction GIIP
Compensation / Enhancement	- None identified
Monitoring	- Regular (daily) monitoring of dust episodes, soiling of vegetation, dust resuspension on the roads and dust clouds at Project site. - Maintain logbook: record any traffic incidents. - Stakeholder grievance related to traffic and road condition.

8.7.9 Residual Significance

Following the application of the mitigation measures outlined in Table 75Table 48, the magnitude of the impact is expected to reduce for all receptors. The residual significance post mitigation is summarised in Table 76. The assessment has indicated that traffic and transportation impacts due to the construction and decommissioning phase would be insignificant.

Table 76: Traffic and transportation residual significance

Adverse impacts	Magnitude pre mitigation	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Road infrastructure (unsurfaced roads) (construction and decommissioning)	Moderate	Medium	Low	Minor
Road users) (mainly local community) (construction and decommissioning)	Moderate	Medium	Low	Minor

8.7.10 Data limitations and uncertainty

None identified.

8.8 Biodiversity

8.8.1 Potential impacts

The construction, operation, and decommissioning of the Project may generate a number of impacts on various sensitive biodiversity receptors, including nineteen species classified as Priority Biodiversity Features (PBFs), per EBRD PR6, and one Natural Habitat (NH) feature, per IFC PS6.

The Project has potential to generate the following types of impacts to sensitive biodiversity receptors:

- Introduction of invasive species
- Habitat/vegetation loss and degradation (terrestrial)
- Habitat degradation (aquatic)
- Disturbance to, and persecution of animals
- Injury/death of terrestrial (non-flying) animals
- Bird collisions with powerlines

The Project does not overlap, nor does it have the potential to generate significant adverse impacts to any national or international protected area. The nearest protected area is:

- Lake Dengizkul IBA, Ramsar site, and state protected area, approximately 8 km southwest of the site.

No impacts from construction, operation, or decommissioning will occur on any protected areas. Impacts to these areas are not considered further.

8.8.2 Receptor sensitivity

Twenty distinct biodiversity features have been identified as Priority Biodiversity Features (PBFs) or Natural Habitat (NH) features, potentially sensitive to impacts from the Project, based on the definitions and criteria of IFC PS6 and EBRD PR6. No features were identified as Critical Habitat triggers for the Project (refer to Volume III: ESIA Technical Appendices - Nur Bukhara Critical Habitat Assessment, June 2023). For the purpose of this impact assessment, these twenty biodiversity features that may experience impacts from the Project, are termed “receptors,” and their sensitivity is scored and presented in Table 77, following the receptor sensitivity classification rubric presented in Table 43.

Table 77: Biodiversity receptors included within the Impact Assessment for the Nur-Bukhara Solar Project

Receptor	Taxon	Sensitivity	PBF/NH
Terrestrial habitat/vegetation	N/A	Low	NH
Calligonum matteianum	Plant	High	PBF
Calligonum molle	Plant	High	PBF
Calligonum paletzkianum	Plant	Medium	PBF
White-headed Duck	Bird	Medium	PBF
Marbled Teal	Bird	Medium	PBF
Macqueen’s Bustard	Bird	Medium	PBF
Sociable Lapwing	Bird	Low	PBF
Dalmatian Pelican	Bird	Low	PBF
Egyptian Vulture	Bird	Low	PBF

Receptor	Taxon	Sensitivity	PBF/NH
Pallas's Fish-Eagle	Bird	Low	PBF
Steppe Eagle	Bird	Low	PBF
Saker Falcon	Bird	Low	PBF
Central Asian Tortoise	Reptile	Medium	PBF
Goitered Gazelle	Mammal	Medium	PBF
Central Asian Otter	Mammal	Medium	PBF
Amu Darya Shovelnose Sturgeon	Fish	Medium	PBF
Small Amu Darya Shovelnose Sturgeon	Fish	Medium	PBF
Aspiolucius esocinus	Fish	Medium	PBF
Capoetobroma kuschakewitschi	Fish	Medium	PBF

8.8.3 Construction phase

8.8.3.1 Habitats and Flora

Habitat/vegetation loss and degradation. The Project will permanently replace approximately 645 ha of shrub desert vegetation with PV solar panels, BESS and substation. This vegetation is currently used for domestic livestock grazing by local villagers, but it contains a viable assemblage of largely native species and retains the basic structure and ecological function of natural Kyzylkum desert vegetation, hence it is classified as Natural Habitat, per IFC PS6, subject to a "no net loss" mitigation standard. This vegetation type is relatively widespread within the region. The pre-mitigation magnitude of impact on desert vegetation communities is considered HIGH.

Direct impacts to sensitive plant species. Three plant species with protected status (*Calligonum matteianum, C. molle, C. paletzkianum*) were documented on site in the baseline characterization, and are classified as PBFs for the Project, subject to a "no net loss" mitigation standard. The construction of the Project will result in the loss of some mature individuals of these species. The pre-mitigation magnitude of impact on sensitive plant species is considered to be HIGH.

Accidental introduction of invasive species. The presence of humans, vehicles, and heavy machinery within the Project area may result in the accidental introduction of invasive species. This impact could occur throughout the Project's life cycle, as a function of the level of human and vehicular traffic, thus concentrated within the construction and decommissioning phases. No invasive plant species were identified in the baseline floral survey or habitat mapping. Impact magnitude is deemed to be LOW given the absence of invasive species at this time, and the relative insensitivity of central Asian desert/steppe environment to this type of impact[130].

8.8.3.2 Terrestrial and Aerial Fauna

Two species of terrestrial (non-flying, and non-aquatic) animals, Goitered Gazelle and Central Asian Tortoise, were identified as PBF in the baseline characterization. These, plus Macqueen's Bustard, may experience either *Habitat loss/degradation* Impacts or *Disturbance/persecution* impacts during the Project's construction and/or decommissioning phases. The former is considered to be a function of the areal extent of an animal's habitat/vegetation that is removed

[130] Esanov H.K. (2016) The alien fraction of the flora of Bukhara oasis. Stapfia 105: 92–98.
Esanov H.K. (2017) Analysis of the flora of Bukhara Oasis. Abstr. PhD Thesis. Tashkent. 45 p. (In Uzbek and Russian)
Esanov H.K. (2019) Flora of Bukhara Oasis. Durdona Publishers, Bukhara. 128 p. (In Uzbek)

either permanently (within the footprint of solar panels or other Project infrastructure that will persist throughout the operations phase) or temporarily (within construction laydown areas, or other temporarily disturbed areas), while the latter may extend to a broader area, depending on the sensitivity of each animal to disturbance from construction activities, which may cause certain animals to experience disruption of normal activity patterns (disturbance), or to be directly persecuted by construction workers even outside of the Project's soil disturbance footprint.

Considering the apparent absence (Macqueen's Bustard), or scarcity (Goitered Gazelle, Central Asian Tortoise) of sensitive terrestrial animal species from the footprint of the Project area, as well as the general unsuitability of the habitat within the Project area for these three species, the pre-mitigation magnitude of *Habitat loss/degradation* and *Disturbance/Persecution* impacts during Project construction is considered to be LOW.

Injury or death of terrestrial animals. The Project may cause the injury or death of terrestrial (non-flying, non-aquatic) animals during the Project's construction phase primarily through the activities of heavy machinery, as well as vehicular traffic within the area. The Central Asian Tortoise and small terrestrial vertebrate species are particularly at risk of this, as they dwell on, or underneath the soil/substrate, and as soil disturbing activities of heavy machinery may result in the death or injury of such animals. Reptiles and amphibians are particularly vulnerable to injury during the hibernation period where they are less active (or inactive) and unlikely to naturally leave the area nor can they be relocated prior to works commencing. The pre-mitigation magnitude of the impact of injury or death to the Central Asian Tortoise is assessed as MEDIUM (although for the Central Asian Tortoise this could be low, based on the scarcity of this species within the area).

8.8.3.3 Aquatic Fauna

Four species of CR/EN fish and one aquatic mammal (Central Asian Otter) comprise the aquatic animals that were identified as PBF in the baseline characterization. These species may experience either *Habitat degradation* Impacts or *Disturbance/persecution* impacts during the Project's construction and/or decommissioning phases. The former may be generated by inputs of dust, stormwater runoff, or hazardous materials into the ABIS canals as a result of construction activities, while the latter may occur if fish or otters are directly persecuted by construction workers during Project construction.

The pre-mitigation magnitude of *Habitat degradation* and *Disturbance/Persecution* impacts during Project construction is considered to be MEDIUM. Persecution impacts will be mitigated with signage and training to prevent construction workers from poaching or harassing sensitive wildlife. Habitat loss/degradation impacts to sensitive aquatic wildlife species will be mitigated by the establishment of a 70 m setback of the site boundary fencing from the ABIS canal, as well as implementation of a standard set of construction-phase measures to mitigate potential impacts of construction activities related to water quality, dust, and hazardous materials and pollution.

8.8.4 Operations phase

8.8.4.1 Avifauna

Bird collision with PV panels. This is not considered a significant source of potential impact. Although there are some solar projects in California, USA, where some birds have collided with solar panels, it is not currently believed to be a widespread, general, or significant adverse impact of PV solar projects, following GIIP.

Bird collision with powerlines. Certain types of birds may experience injury or death from collisions with powerlines during the Project's operations phase. This type of impact is believed to occur because certain birds have difficulty seeing the cables of the OHTL while in flight, thus colliding with them if they are on the birds' flight path. For this reason, the overhead, or static wire of OHTL is generally the most hazardous for bird collisions, as it is generally the narrowest cable, and hence the least visible to a flying bird. Bird collisions may occur anywhere along the spans (line segments between pylons or towers) of the OHTL, and are generally concentrated where OHTLs pass directly through, or in close proximity to water bodies, wetlands, or other habitats that are known to concentrate collision-prone bird species.

Birds' susceptibility to collisions with OHTLs varies substantially across species, with highest collision susceptibility generally associated with large-bodied bird species that possess relatively high wing-loading (the proportion of body weight to the size of the wings), as this type of flight morphology renders these species less buoyant and manoeuvrable in flight. Bird collisions with OHTLs are also associated with visual capacity and flight behaviour of various bird taxa, as well as lighting and weather conditions that may affect the visibility of the cables. Sensitive collision-susceptible bird taxa potentially affected by the Project include Macqueen's Bustard, Marbled Teal, White-headed Duck, and Dalmatian Pelican, all of which are classified as PBFs for the Project, as well as certain other migratory birds, especially migratory water birds.

The Project will entail the construction of only ca. 30 m of new overhead, high-voltage (220kV) transmission line, hence the extent of this potential impact is limited. In addition, either side of the new connection tower approximately 100 m of new conductor (to replace the existing line) will be required to the towers immediately adjacent to the new connection tower to connect the substation to the existing line. Because there are ABIS canals and other water bodies that attract waterbirds in the immediate vicinity of the Project area, the Project does have potential to generate collision impacts for birds, including the four collision-susceptible species classified as PBF for the Project, listed above, hence the pre-mitigation magnitude of this impact is assessed as MEDIUM.

8.8.5 Decommissioning

During decommissioning of the PV site, BESS and substation the infrastructure both above and below ground will be removed. This requires many of the same activities on site and may lead to many of the same impacts as experienced during the construction phase. Impacts may include:

- Injury/death – Central Asian Tortoise

- Disturbance/Displacement (all species) that may return to the Project site during the operational period.
- Habitat/vegetation loss and degradation (terrestrial) for vegetation that has returned under and around the Project infrastructure and for temporary laydown and decommissioning site offices.
- Habitat degradation (aquatic) for generation of dust, noise and other nuisances.

8.8.6 Cumulative impacts

The presence of the additional 30 m of new OHTL is not expected to lead to a combined pressure on the functionality of ecosystem performance and therefore no cumulative impacts are envisaged.

8.8.7 Summary of impact magnitude

Table 78 details the impact magnitude for the impacts identified above. The scoring of impact magnitude follows the rubric presented in the impact assessment methodology section (Table 44).

Table 78: Summary of magnitude – biodiversity

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Habitat loss/degradation – desert vegetation Natural Habitat	High	Permanent	Direct AOI	Irreversible (without intervention)	High	High
Habitat loss/degradation – PBF plants (*Calligonum matteianum, C. molle, C. paletzkianum*))	High	Permanent	Direct AOI	Irreversible (without intervention)	High	High
Accidental introduction of invasive species	Low	Permanent	Direct AOI	Reversible	Low	Low
Habitat loss/degradation – PBF terrestrial animals (Goitered Gazelle, Central Asian Tortoise, Macqueen's Bustard)	Low	Permanent	Direct AOI	Reversible	Low	Low
Habitat degradation (aquatic) – PBF fish (4 species) and aquatic mammal (Central Asian Otter)	Medium	Permanent	Direct AOI	Reversible	Low	Medium
Disturbance/Persecution – Macqueen's Bustard, Goitered Gazelle, two duck species, four fish species, Central Asian Tortoise, Central Asian Otter	Medium)	3-6 months	Direct AOI	Reversible	Low	Low
Injury/death – Central Asian Tortoise	Low	3-6 months	Indirect AOI	Reversible	Low	Low
Collision with powerlines – Sociable Lapwing	Medium	Permanent	Direct AOI	Permanent	Medium	Medium
Collision with powerlines or PV Panels– sensitive water birds (Dalmatian Pelican, White-headed Duck, Marbled Teal) and Macqueen's Bustard	Medium	Permanent	Direct AOI	Permanent	Medium	Medium

8.8.8 Mitigation, management and monitoring measures

In order to mitigate the anticipated impacts to biodiversity, a set of mitigation measures has been identified, following the mitigation hierarchy, and based on a review and analysis of effectiveness and feasibility of potential mitigation options. These mitigation measures are listed and described in Table 79. All mitigation defined here must be elaborated in a BMP (Volume IV - ESMP) and the project ecologist will review and give final instructions regarding where specific mitigations might need to be installed based on the final surveys, design and other factors.

Table 79: Biodiversity mitigation and management

Project phase	Mitigation and management measures
Design (to be included in the Contactor RFP design specification)	OHTL Design Specification in Contract to include requirement to undertake the following for approval of the final design by a qualified project ecologist. - Install Bird Flight Diverters on overhead, or static lines of the OHTL following GIIP, on all new (30 m) and/or refurbished sections of 220 kV powerline. - Maintain 70 m setback from the fence line to the edge of the ABIS canal. - Limit vegetation removal to only the necessary requirements - Select fencing that allows the free movement of small fauna onto and across the site to support habitat restoration goals and limit biodiversity impacts.
Construction - Project Specific	- • Pre-construction tree count survey (in accordance with national requirements) (completed June 2023). - • Terrestrial animal survey and rescue/relocation effort conducted immediately prior to construction, with focus on Central Asian Tortoise - E&S Biodiversity supervisor to be present on-site during site preparation works to assure compliance with construction phase mitigation measures, and to conduct daily searches and animal rescue, as needed, with a focus on Central Asian Tortoise. - Signage and training to prevent construction workers from poaching or harassing sensitive wildlife.
Construction - GIIP	- Minimize soil/vegetation disturbance during construction and where required use sustainable soil / vegetation techniques as described in section 8.6.8. - Use only demarcated area for laydown and access (construction and operation) - Minimise use of trenches or other steep-walled excavations. - Backfill open excavations as soon as possible after construction activity. - Rehabilitate temporarily disturbed areas as soon as possible after construction activity is finished to minimise risk of shifting sands. - Worker/contractor training/awareness, supervision regarding impacts to animals and protection of species. - Prohibit poaching and interactions with fauna and flora in the worker code of conduct. - Monitor spread of invasive species during construction and vegetation compensation plan implementation - Establishment, posting, and enforcement of vehicular speed limits, and other traffic management measures. - Implement good housekeeping measures for materials handling, waste management, dust mitigation, and stormwater runoff management. - Prepare decommissioning management plan (including management of biodiversity impacts) prior to decommissioning.

Project phase	Mitigation and management measures
	- Prohibit poaching (CITES species) and interactions with fauna and flora in the worker code of conduct.
Operation	- Chance find bird fatality monitoring protocol implemented, supplemented by periodic searches under OHTL and around PV panels for first 3 years post-commissioning - Develop no net loss management plan - Establishment of on-site Vegetation Conservation Areas for NH compensation where native vegetation will be restored through transplant of nursery-cultivated seedlings of rare and common native plants to achieve NNL mitigation standard in consideration of impacts to NH and PBF. The aim is to restore vegetation degraded by grazing prior to the project to a condition good enough to compensate for project impacts elsewhere on site (to be elaborated in the Project BMP). - Replanting program for redlisted plants removed during construction (*Calligonum matteianum, C. molle, C. paletzkianum*) using nursery-cultivated seedlings grown on-site from seeds acquired from adjacent site. (elaborated in the BMP)
Decommissioning	Pre-decommissioning ecological site survey to confirm habitat/species re-colonised the site and surrounding areas. - Minimize soil/vegetation disturbance during construction and where required use sustainable soil / vegetation techniques as described in section 8.6.8. - Use only demarcated area for laydown and access (construction and operation) - Minimise use of trenches or other steep-walled excavations. - Backfill open excavations as soon as possible after construction activity. - Rehabilitate temporarily disturbed areas as soon as possible after construction activity is finished to minimise risk of shifting sands. - Worker/contractor training/awareness, supervision regarding impacts to animals and protection of species. - Prohibit poaching and interactions with fauna and flora in the worker code of conduct. - Establishment, posting, and enforcement of vehicular speed limits, and other traffic management measures. - Implement good housekeeping measures for materials handling, waste management, dust mitigation, and stormwater runoff management. - Prepare decommissioning management plan (including management of biodiversity impacts) prior to decommissioning. - Prohibit poaching (CITES species) and interactions with fauna and flora in the worker code of conduct.
Enhancements	- Vegetation conservation/restoration program (above) will also mitigate habitat-related impacts to several sensitive species that utilize upland desert habitats, and that are classified as PBFs for the Project (Goitered Gazelle, Macqueen's Bustard, Central Asian Tortoise). - Re-vegetation on site (around panels) to restore impacted land in the project direct AOI and general activities to improve pastures where appropriate. - Select fencing that allows the free movement of small fauna onto and across the site (through a gap of circa 20 cm under the fence) to support habitat (and soil) restoration goals and limit biodiversity impacts.
Monitoring	- Monitoring effectiveness of off-site Natural Habitat restoration/rehabilitation against "No Net Loss" criteria (short, medium and long term)

Project phase	Mitigation and management measures
	- Monitor reptile and amphibian levels on offset site annually and main site. - Monitor seed re-planting efforts (at least 3 years).

8.8.9 Residual significance

Table 80 presents the residual significance assessed for each adverse biodiversity impact anticipated for the Project, where the set of individual impacts is defined as all of the distinct types of impacts described earlier, broken out separately for different receptors of that impact, grouped by sensitivity level. Impact magnitude and residual significance are considered in a post-mitigation (residual) context, assuming implementation of the mitigation measures described in the previous section. Receptor sensitivity and impact magnitude and residual significance are scored according to the impact assessment methodological rubric presented in section 5.3.

Table 80: Biodiversity residual significance

Adverse Impact	Magnitude (pre-mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Construction				
Habitat loss/degradation –desert vegetation Natural Habitat	High	Low	Low	Neutral
Habitat loss/degradation – PBF plants (*Calligonum matteianum, C. molle, C. paletzkianum*)	High	High	Low	Neutral
Habitat loss/degradation – PBF terrestrial animals (Goitered Gazelle, Central Asian Tortoise, Macqueen's Bustard)	Low	Medium	Low	Minor
Habitat degradation (aquatic) – PBF fish (4 species) and aquatic mammal (Central Asian Otter)	Medium	Medium	Low	Minor
Introduction of invasive species	Low	Low	Low	Neutral
Disturbance/Persecution – Macqueen's Bustard, Goitered Gazelle, two duck species, four fish species, Central Asian Tortoise, Central Asian Otter	Low	Medium	Low	Minor
Injury/death – Central Asian Tortoise	Low	Medium	Low	Minor
Operation				
Collision with powerlines – Sociable Lapwing	Medium	Low	Low	Neutral
Collision with powerlines – sensitive water birds (Dalmatian Pelican, White-headed Duck, Marbled Teal) and Macqueen's Bustard	Medium	Medium	Low	Minor
Disturbance/Displacement (all other avifauna species)	Medium	Low	Low	Neutral

8.8.10 Data limitations and uncertainty

The robustness and certainty of the critical habitat / priority biodiversity features assessment and biodiversity impact assessment conclusions presented within this section are limited by heterogeneity in the extent of existing scientific knowledge regarding sensitive species' distributions, ecology, and susceptibility to impacts from PV solar projects and powerlines within Uzbekistan.

Furthermore, due to the seasonality of seed ripening in sensitive plant species and government restrictions on direct sampling of protected fish species, the baseline survey effort contains some primary data collection gaps for some species. In order to account for such gaps, secondary information sources were used in all cases, and conservative assumptions were made based on the best available scientific information.

8.9 Labour (employment, procurement, worker welfare)

8.9.1 Potential impacts

Labour impacts can be felt by workers working on the project and by community members considered 'local' (in this case assumed to mean from the communities of Kirlishon and Kulchovdur – but this may be further defined by the main contractor). Potential labour impacts during the construction, operation and decommissioning period include:

- Job creation and priority procurement from local communities, (positive).
- Increased local spending in the local economy resulting from local jobs and procurement (positive).
- Poor working terms and conditions affect worker wellbeing (including forced and child labour) (on site and in the supply chain).
- Inadequate worker accommodation.
- Gender-based violence and harassment (GBVH) in the workplace affecting worker wellbeing[131].

8.9.2 Receptor sensitivity

The primary receptors for Project are considered to be the local communities of Kirlishon and Kulchovdur (where the local workforce will be sourced), and the Project workers. Sensitive labour receptors are summarised in Table 81.

Table 81: Project labor receptors

Receptor	Description	Sensitivity
Masdar and EPC Contractor salaried workers	Will be impacted during the construction and operation phases. Salaried workers are more likely to have security of employment through long-term contracts and have a good idea of their rights and access to leave and other benefits.	Medium

[131] GBVH impacts in the community are addressed in Community Health, Safety and Security section.

Receptor	Description	Sensitivity
EPC Contractor and sub-contractor contract workers	Only impacted during construction, but less likely to have protections and knowledge of rights.	Medium
Local community members	These communities have potential for employment or procurement impacts during the construction or operations phases but may not have knowledge of their rights.	High

8.9.3 Construction phase

The EPC Contractor has estimated that the number of workers will reach 600 workers at the peak of the construction phase. During the early stages of the Project the worker numbers will be low (under 100). The peak workforce is likely to comprise a mix of highly qualified specialists, technicians (approximately 40% or the workforce will be skilled) and low-skilled personnel (approximately 60% of the workforce).

Given the rural location of the Project site, it is unlikely that people skilled in solar PV and OHTL construction will be able to be identified in the local communities. Therefore, the majority of construction workers are likely to be sourced from further afield by the EPC contractor.

There is potential for a small amount of unskilled or semi-skilled temporary employment generation during the construction phase that will result from the ground clearance, construction of the foundations and building structure, drivers and security work. This type of work may be sourced from the local communities. There is also a possibility that the Project may source some of its procurement contracts from local communities as well (such as food or raw materials).

Although local construction jobs and local procurement contracts will be temporary, they will be a positive impact for local communities and could contribute to livelihood security. In addition, earnings from Project jobs will likely be spent on local goods and services, at least to some extent, which will have induced socio-economic benefits on local communities. Skills and experience gained through this small amount of temporary work experience will benefit the workers' future job prospects. There are high numbers of unemployed people in the local communities that could benefit from employment.

Given the small number of local workers, it is unlikely that private employment agencies will be used. However, if they are used there is a risk that workers may be forced to pay recruitment fees, which would reduce the benefit the individual receives from gaining employment and may put the worker in a vulnerable position.

Local and migrant workers can be the most vulnerable to risks related to working conditions. However, such risks could affect all construction workers. Some possible risks for this project include lack of, or insufficient personal protective equipment (PPE), no provision of a work contract or other relevant documentation, lack of payment or insufficient payment of overtime hours, or unsuitable accommodation, among others. In addition, workers that are new to construction work may be unaware of their rights in the workplace. The abovementioned risks can impact a workers'

health, wellbeing or their livelihood during the employment period. Security guards[132] and day labourers[133] are often some of the more vulnerable workers on a work site. Uzbekistan has ratified the eight fundamental ILO conventions and has protections in place for salaried workers (e.g., those hired by Masdar or the EPC Contractor), therefore, salaried workers are less at risk than short-term contract workers.

Community members have requested that they be hired as a priority for construction jobs and there may be some community unrest if no, or insufficient, employment opportunities are provided in the Project and all employment opportunities are given to migrant workers.

Temporary construction worker accommodation camps could expose workers to the risks of illness. The EPC and any subcontractors will be required to implement a Worker Accommodation Management Plan (that forms part of the construction ESMS) and addresses: sleeping areas; sanitary and toilet facilities; canteen, cooking and laundry facilities, standards for nutrition and food safety, medical facilities, and leisure, social and telecommunication facilities. The accommodation would be required to meet the requirements of the *Workers' accommodation: processes and standards; A guidance note by IFC and the EBRD* (April 2009). Workers will not be charged for accommodation and related services.

Incidences of forced and child labour have been identified in Uzbekistan (particularly in the cotton industry, and not specific to construction work). However, the country has been working to reduce the incidence of forced and child labour, including ratifying the ILO conventions on forced labour, minimum age and worst forms of child labour, which has allowed the incidence to reduced significantly in recent years. In addition, this type of project will likely use more skilled labour (particularly in the operations phase) and given that workers are more likely to be salaried and informed of their rights, child and forced labour is not considered a high risk for this Project.

There is a minor risk of human rights abuses and harassment as a result of the Project. There is no current evidence that the Project will impact gender-based violence and harassment (GBVH), or that the Project is in a location where GBVH is prevalent. However, this will need to be confirmed and monitored by the EPC Contractor during construction. In addition to directly employed Project workers, the Project will also consider the workers in the Project supply chain to verify that indirectly affected Project workers will be subject to the same working conditions as those on the Project site. Supply chain workers could be located in Uzbekistan or in other countries and they may be more vulnerable to unsafe work sites. Direct monitoring from Project personnel, considering the prevalence of forced and child labour is required in particular related to the supply of polysilicon for the solar PV panels and the battery storage. A full assessment of this impact is undertaken separately to this ESIA and is available via supplementary reports.

[132] Security guards are often overlooked in labour monitoring and have different working hours and legal requirements to general workers, which can be confusing for the workers and can allow them to fall through the cracks.

[133] Day laborer's often do not receive sufficient training, or explanation of their worker rights. They may feel their working position is precarious and not feel as if they can raise concerns.

8.9.4 Operation phase

The operational phase is not expected to create a significant number of employment opportunities, and the majority of those will be for skilled workers hired by Masdar or its O&M contractors. The total workforce is not expected to exceed 25 workers. Employment for local community members could be provided in security, vegetation clearance, and maintenance works. There is a minor risk related to working conditions during the operations phase, as the majority of workers will be salaried workers. Unskilled workers and security guards have historically been the most at-risk of poor, or insufficient working conditions, as they are less likely to know or feel able to enforce their rights. Security guards are often hired under different conditions from the remainder of the workers and therefore need to be provided specific information on their working conditions.

8.9.5 Decommissioning phase

Labour requirements for the decommissioning phase will be similar to the construction phase.

8.9.6 Cumulative impacts

There are two other construction works being undertaken in the Project area, the Khamza 1 and Khamza 2 substation works. No significant impacts on local communities have been identified in relation to these works based on consultations with the local communities, which suggests that there will also be no impacts on Project workers. As the workers for the Khamza 1 and Khamza 2 projects are mainly migrant workers from China and other parts of Uzbekistan, it is unlikely that there will be a lack of local labor pool as a result of the three projects working concurrently. One project is expected to be completed at the end of 2023 and the other at the end of 2024, so there will be at least one year of overlap.

There could be cultural differences between the expatriate workers for the Project, predominantly from India, and the Chinese and Uzbek workers from the Khamza 1 and Khamza 2 projects that could lead to conflict. This will be managed through cultural sensitivity training, and implementation of the worker grievance mechanism, worker code of conduct and disciplinary procedures (in the HR policy).

The completion of the works at Khamza 1 and Khamza 2 may have a positive impact of providing a source of labor with construction experience for the Project.

8.9.7 Summary of impact magnitude

Table 82 details the impact magnitude for the impacts identified above.

Table 82: Summary of magnitude – Labor

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Construction						
Job creation	Medium	1 to 16 months	Indirect AOI	Reversible	Intermittent / Medium	Medium

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Increased local spending	Medium	1 to 16 months	Indirect AOI	Reversible	Intermittent / Medium	Medium
Working conditions and wellbeing – Masdar and EPC Contractor workers	Medium	1 to 16 months	Indirect AOI	Reversible	Low	Medium
Working conditions and wellbeing skilled contract workers	Medium	1 to 16 months	Indirect AOI	Reversible	Low	Medium
Working conditions and wellbeing unskilled/migrant contract workers	Medium	1 to 16 months	Indirect AOI	Reversible	Intermittent / Medium	High
Unsatisfactory/non-compliant worker accommodation	Medium	1 to 16 months	Indirect AOI	Reversible	Intermittent / Medium	Medium
GBVH in the workplace	Medium	1 to 16 months	Indirect AOI	Reversible	Intermittent / Medium	Medium
Operation						
Poor working terms and conditions	Low	Project duration	Indirect AOI	Reversible	Low	Low

8.9.8 Mitigation, management and monitoring measures

Table 83 outlines GIIP and feasible and cost-effective measures to prevent or minimise labour impacts for all phases.

Table 83: Labor mitigation and management

Project phase	Mitigation and management measures
Design/Contracts	- Require contractor (via EPC Contract) to conform to Masdar Human Resources (HR) Policy, Code of Ethics, Policy Against Bribery and Corruption, Recruiting Policy, Supply Chain (Procurement) Policy, and Communication Policy - Requirements for the EPC Contractor and Tier 2/3 sub-contractors to demonstrate functioning HR policies aligned with Lender requirements, ILO core conventions and Uzbek law, in contractor contracts. - Unbundle procurement contracts so that local community members have a greater chance of supplying the Project and advertise procurement contracts locally and in local languages. - Define manpower requirements for the construction and operation phase for Masdar, the EPC Contractor and subcontractors, including the number of E&S personnel and their qualifications. - Contractor ESMS and C-ESMP prepared and accepted by Masdar, the Lender and/or the EPC Contractor. - Perform a supply chain due diligence or obtain third-party supply chain due diligence reports to verity potential suppliers' credentials regarding the occurrence of forced labour, child labour or occupational health and safety failures. The supply chain will be mapped (to the polysilicon level) and verified by an independent consultant for point of origin.

Project phase	Mitigation and management measures
	- Suppliers shall have a system to identify and manage risks associated with child labor, forced labor, occupational health and safety and pollution prevention for their activities and their core supply chain.

Construction - Project Specific	- Adopt Masdar E&S Policy (refer to Volume IV ESMP) which includes *inter alia*:
	  - Commitment to adherence to core labor standard
	  - Prohibition and zero tolerance to child and forced labor. Screening of contractors, subcontractors and supply chain on child and forced labor will be taken into account.
	  - Screen supply chain to minimize labor risks.
	- EPC Contractor to hire a site HR Manager and EPC Contractor accommodation HSE Officer as part of the EPC Contractor team.
	- EPC Contractor to Prepare a Labor and Working Conditions Management Plan (Volume IV, ESMP)
	- EPC Contractor to Prepare a
	- All EPC Contractor staff to be trained (as part of the induction) on labour terms and conditions (aligned with IFC PS2)
	- Confirm the villages that will be considered 'local' for the purpose of local hiring (suggested Kirlishon and Kulchovdur communities, but this may need to be widened).
	- Discuss with Alat district khokimiyat and local communities the employment and procurement contracts available, in order to manage expectations of the number of local jobs that will be available.
	- Prioritize employment of local community members where possible.
	- Prioritize procurement of goods from local communities where possible.
	- Prioritize employment of women and people from vulnerable groups (including impacted herders) where possible.

Construction – GIIP	- EPC to prepare HR policy for the Project that meets Lender and ILO requirements and specifically prohibits the use of child and forced labour and encourages non-discrimination. - All Contractors to submit for review their own HR Policies or to adhere to the Project's HR policy. - Prepare a policy on prioritising local employment. - EPC and subcontractors to commit to having written work contracts available for all the Project employees that would clearly specify their terms of employment, consistent with the local labour law and the IFC PS2. - Refrain from hiring day labourers or undertaking hiring "at the gate". - Require all workers to sign a "code of conduct". - Prepare and require all contractors and their subcontractors to adhere to a "labour management plan" which sets out requirements for contractors, including disciplinary actions. - Undertake a selection process (to be described in the Labor and Working Conditions Management Plan) for selection of accommodation when it is offsite. - Provide worker accommodation in line with the EBRD and IFC Guidance on worker accommodation[134]. - Prepare a Worker Accommodation Management Plan (Volume IV, ESMP). - Disclose community grievance mechanism to houses surrounding the worker accommodation pre-construction. - Set up E&S Training Management Plan (Volume IV, ESMP) for all workers, including inductions and regular refresher training. - Include aspects of cultural sensitivity training in the worker induction.

[134] Workers' Accommodation: Processes and Standards (ifc.org)

Project phase	Mitigation and management measures
	The Project Company will be responsible for providing relevant information and training to Project Company personnel and the EPC Contractor (and other contractors as relevant) about the grievance mechanism, who should be informed (such as security guards, who may need to log grievances from community members) and that all grievances (even if they are resolved on the spot) need to be reported to the Project Company for logging.[135] Ongoing training on the GM will be given to all workers during the site induction. - Prepare disseminate and train workers in the worker grievance mechanism (it should also include requirements for GBVH grievances). - Perform a tier 1 supply chain due diligence / obtain the third-party supply chain due diligence reports to verity potential suppliers' credentials regarding the occurrence of forced labour child labour or occupational health and safety failure. - Monitor private employment agencies (if used) for recruitment fees and ensure they are paid by employers rather than prospective job applicants. - Ensure provisions on site for female workers (segregated toilers and accommodation (if required).
Operation and Maintenance	- Establish Operational HR Policy in line with Masdar HR Policy - Implement Worker code of conduct and GBVH code of conduct (including grievance mechanism) - Update worker grievance mechanism for the construction phase. - Update the E&S Training Management Plan for operations including inductions and regular refresher training. - Continue to prioritise local employment, where possible. - Ensure provisions on site for female workers (segregated toilets and changing rooms).
Decommissioning	- As per Construction-GIIP above
Enhancement	- Prepare a Gender Management Plan to encourage employment of workers from local communities and women. Include training 3 months in advance of the start of the operations in order to identify and train as many local people as possible who were employed at the construction stage, to make them skilled enough in order to continue to work on the Project during the operation stage
Monitoring	- Weekly reporting of statistics for local workers, including gender-disaggregated workforce numbers in construction and operations monitoring reports. - Weekly reporting against KPIs (as defined in the ESMP, Volume IV) - Undertake labour audit for EPC Contractor and its selected subcontractors' compliance against Labor Management and Working Conditions Management Plan once every two months (construction), and annually (operations) to identify any gaps in payment, provision of personal protective equipment and/or any other concerns regarding human resources to include review of working conditions, paysheets and payslips, leave allocation, and interview with workers to verify findings (internal). - Commission an independent labour audit of all subcontractors within four weeks of mobilization on site. - Undertake audit for EPC Contractor compliance against EPC Worker Accommodation Management Plan monthly.

[135] A separate worker grievance mechanism will also be put in place for workers to raise grievances, which will be managed by the EPC Contractor.

Project phase	Mitigation and management measures
	- Review labour and working conditions management and worker accommodation management every three months (part of internal or external E&S audit), annually during operations. - Monitor the project's impact on GBVH. - Monitor influx of people (number of new people in the community and their demographics if possible) if a significant influx of temporary workers or followers is observed (not anticipated), develop influx management plan.

8.9.9 Residual Significance

Following the application of the mitigation measures outlined in Table 83. The residual significance post mitigation is summarised in Table 84. The assessment has indicated that labour impacts will not be significant. There is the potential for moderate positive impacts from local employment and procurement.

Table 84: Labor residual significance

Impacts	Magnitude (pre mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Local job creation and spending	Low	Medium	Medium	Moderate (positive)
Local Procurement	Low	Medium	Medium	Moderate (positive)
Working conditions and wellbeing – Masdar and EPC Contractor salaried workers		Medium	Medium	Low / Minor
Working conditions and wellbeing skilled contract workers	Medium	Medium	Low	Minor
Working conditions and wellbeing unskilled/migrant contract workers	High	High	Low	Moderate
Unsatisfactory/non-compliant worker accommodation	Medium	Medium	Low	Minor
GBVH in the workplace	Medium	Medium	Low	Minor
Poor working terms and conditions (operation)	Low	Low	Low	Neutral

8.9.10 Data limitations and uncertainty

Total workforce numbers have not been fully determined at the time of writing this report and could vary (however, not excessively).

8.10 Occupational health and safety

8.10.1 Potential impacts

Occupational health and safety (OHS) hazards during construction, operations and decommissioning of the PV, BESS and OHTL works include a range of physical, chemical, and biological hazards.

8.10.2 Receptor sensitivity

All workers during the construction and operations phases of the Project will be receptors for OHS risks. Sensitivity of OHS receptors are summarised in Table 85

Table 85: Project OHS receptors

Receptor	Description	Sensitivity
Construction workers (all)	Workers with no construction experience will be more vulnerable, but the risk will be there for all workers during construction. In addition, the prioritisation of OHS management can be expected to be low without strong leadership.	Medium
Operations workers (all)	Workers will be mainly skilled and contracted for extended periods of time, making them less vulnerable to OHS risks.	Low

8.10.3 Construction phase

OHS is generally considered a risk rather than an impact, as accidents and incidents relating to OHS cannot be predicted and could occur at any time. Generally speaking, in Uzbekistan it is often observed that low priority is given to OHS measures (such as contractors' workers not wearing personal protection equipment (PPE), open trenches without safety fencing). In addition to the general construction site risks including exposure to physical hazards from use of heavy equipment and cranes; trip and fall hazards; exposure to dust and noise; falling objects; work in confined spaces; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery. Working with batteries can also present increased OHS risks. Specific procedures must be followed for adequately handling and installing batteries. Care should always be taken to prevent arcing at or near battery terminals, and proper protection must be considered to avoid fire or thermal runaway.

The main construction related OHS risks include the following.

- Fire, thermal runaway (batteries)
- Electrocution (electric arc-flash hazard while adding or removing a series of solar PV panels)
- Induced voltage at worksite
- Lifting operations
- Working at heights
- Exposure to chemicals and hazardous materials
- Emergency and abnormal situations

OHS risks related to the Project location include:

- Working in remote areas
- Extreme temperatures (refer also to section
- Dust storms and other climate related events
- Lightning strikes
- Traffic
- Working in areas where there are wild animals, grazing animals.

Uzbekistan is also prone to natural hazards, including droughts, floods, and earthquakes.

This ESIA has also identified that the soil in the Project area has naturally elevated levels of heavy metals and lead that may also pose and risk to the health of workers, particular during site preparation and excavation works.

The majority of the workforce will be skilled workers, experienced in similar projects, or unskilled people from the local community. However, OHS risks remain, particularly in relation to working from heights, working with electricity and working in a desert environment (heat and dust). The Project site is also isolated, and should an accident occur on the site, the injured party may need to be transported a long way to receive treatment.

8.10.4 Operation phase

Many of the OHS risks during the operation and maintenance (O&M) phase will be similar to those identified during the construction phase, however, they will be significantly reduced in their magnitude due to the reduced number of workers on site, and the types of maintenance work that will be undertaken which will be confined to ground level. The following operational OHS risks are anticipated:

- Electrocution (electric arc-flash hazard while adding or removing a series of solar PV panels)
- Induced voltage at worksite
- Lifting operations
- Working at heights
- Exposure to chemicals and hazardous materials
- Emergency and abnormal situations
- Working in remote areas
- Extreme temperatures
- Dust storms and other climate related events
- Traffic
- Working in areas where there are wild animals, grazing animals.

O&M teams will be required to adhere to an OHS management system aligned to ISO 45001, including requirements for risk assessments and method statements for all maintenance works and permit to work and lockout tag out procedures for major maintenance activities.

8.10.5 Decommissioning phase

OHS risks for the decommissioning phase will be similar to the construction phase including a combination of work related OHS risks and location related OHS risks. OHS risks will include:

- Electrocution (electric arc-flash hazard while adding or removing a series of solar PV panels)
- Induced voltage at worksite
- Lifting operations
- Working at heights
- Exposure to chemicals and hazardous materials
- Emergency and abnormal situations
- Working in remote areas
- Extreme temperatures
- Dust storms and other climate related events
- Traffic
- Working in areas where there are wild animals, grazing animals.

A site-specific risk assessment will be required for the decommissioning phase works based on a review of actual activities to be performed and site-specific conditions at the time of decommissioning.

8.10.6 Cumulative impacts

There are not expected to be any cumulative impacts in relation to OHS.

8.10.7 Summary of impact magnitude

As OHS is a risk, rather than an impact, it is not possible to identify the significance.

8.10.8 Mitigation, management and monitoring measures

Table 86 outlines GIIP and feasible and cost-effective measures to prevent or minimise OHS risks during the construction, operation and decommissioning phases.

Table 86: OHS mitigation and management

Project phase	Mitigation and management measures
Design/Contract	- Incorporate GIIP engineering controls in Project design. - Incorporate measures to reduce the risk of these hazards impacting the project as per national codes and norms and international standard specifications. - Require EPC Contractor to be certified to ISO 45001 (or equivalent) - Require EPC Contractor to implement communication systems to enable communications from any part of the site. - Specify safety signage throughout the Project site, following GIIP specifications and codes of practice. - Fence the site during construction to avoid ingress of unauthorized persons, or wild/grazing animals.
Project Specific	- Workers involved in site clearance works or excavation works to be required to wear appropriately specified dust masks (FFP3 Dust Masks / P3 Dust Masks) to protect against elevated levels of heavy metals. - Establish a comprehensive Construction, Operations and Decommissioning OHS Plans (at relevant times throughout the Project lifecycle).

Project phase	Mitigation and management measures
	- Ensure all workers receive worker induction and regular ongoing training (e.g., toolbox talks, setting to work briefings) on environment, H&S. labour and working conditions, worker code of conduct, GBVH, and other requirements. - EPC Contractor and subcontractors to hire HSE Managers and Officers (1:50 for construction workforce) - Conduct Project specific risk assessment identifying physical chemical, biological and other hazards and prioritising hazard elimination, hazard control and hazard minimisation. - Develop a project specific Emergency Preparedness and Response Plan (EPRP) (Volume IV, ESMP (incorporating risk management protocols for climate related risks, exposure to contamination risks, traffic risks etc). - Include in the EPRP a medical evacuation procedure to enable injured workers to access appropriate emergency facilities. - Ensure medical preparedness includes permanent on-site paramedic, first aid facilities and first aiders (ratio of 1:50 first aiders/workers) on site. - Provide worker shelter, toilets and provisions (including drinking water) at work fronts across the site (not just at the main site camp). - Modify hours of work as needed to reduce working in the hottest periods of the day and train workers on how to identify and what to do in the case of heat stroke (induction). - Employ officers to oversee E&S obligations for the site (may be based elsewhere) - EPC contractor to employ at least one HSE Manager and an EPC Contractor HSE Officer for every 50 workers. - Subcontractors with more than 20 workers shall deploy a dedicated HSE Officer and an additional HSE Officer for each additional 50 workers deployed onsite. - Implement mitigation measures in relation to lead in the soil (including an assessment of required personal protective equipment (PPE) for workers and training in the risk of lead contamination).
Good International Practice	- Workers to receive correct PPE, free of charge and to be replaced when needed. - Workers must receive appropriate training, prior to commencement of work and on an ongoing basis through toolbox talks, oriented by training plans. - Mock drills (including OHS, spills, and emergency drills) should be undertaken regularly. - First aid facilities to be available at all work fronts. - Establish an accident and incident reporting procedure. Including providing incentives for reporting near misses and corrective actions.
Operation and Maintenance	- Establish an operational OHS Plan. - Define workplace protocols for maintenance activities. - Employ EHS officer to oversee Project Company obligations (may be based off site). - Define operations auditing, inspection, and reporting schedule. - Update the emergency preparedness policy and emergency preparedness and response plan for the operations phase. - Disclose updated emergency preparedness and response plan to local emergency services and other relevant external stakeholders (e.g., nearby communities). - Perform continuous monitoring of storm events: e.g., site lock-down securing all equipment and materials.
Decommissioning	- The same as the construction phase.
Enhancement	- None identified.
Monitoring	- Numbers of fatalities, accidents and injuries. - Daily H&S inspections by qualified personnel.

Project phase	Mitigation and management measures
	- Construction and operations auditing, inspection and reporting schedule. - Reviews of incident and accident reporting, drill reporting and any corrective actions identified, where relevant.

8.10.9 Residual Significance

As OHS is a risk, rather than an impact, it is not possible to identify the significance.

8.10.10 Data limitations and uncertainty

None identified.

8.11 Community health and safety and security

8.11.1 Potential impacts

Project activities with the potential to have community, health, safety and security (CHSS) impacts include:

- Project activities pose a hazard to local community through spreading communicable diseases, or nuisance such as dust, noise, or traffic impacts etc.
- Temporary labour influx causing strain on local services.
- Poor worker conduct impacting local communities and in particular vulnerable groups such as women.
- Unauthorized community members accessing the site and causing accidents.
- Conflict between community members and security personnel that could impact either or both parties.
- Traffic and transportation of Project workers and Project components could impact people living along the roadways.

8.11.2 Receptor sensitivity

The primary receptors for the Project in relation to CHSS can be considered to be Kirlishon and Kulchovdur communities. The socio-economic baseline provides a detailed overview of the characteristics of the communities in the direct and indirect AOI. Sensitive receptors in the AOI and their vulnerability to CHSS impacts are summarised in Table 87.

Table 87: Project CHSS receptors

Receptor	Description	Sensitivity
Members of Kirlishon and Kulchovdur communities	They are located closest to the site, and could be impacted by influx, transportation of goods or construction nuisance.	Medium
Herders and Farmer F01	Herders currently graze their livestock on or near the Project site and farmer F01 uses land adjacent to the site. They are likely to be the closest people to the site or work on land near to the Site.	Medium
Workers in the worker accommodation at the	These workers will be located near the Project site temporarily but may also be close enough to be impacted by construction nuisance.	Medium

Receptor	Description	Sensitivity
Khamza 1 and Khamza 2 projects.		
Project workforce	There will be interaction between the workers and the community (particularly those that are housed within the community), community ill-health or safety concerns could result in impacts to workers (with security guards as the first point of contact).	Medium
Vulnerable groups (e.g., women, disabled, elderly, illiterate and youth)	May be more severely impacted and may not be able to recover as well from any impact.	Medium-High

8.11.3 Construction phase

The distance from the nearest communities to the Project and the rural nature of the location, makes it unlikely that there will be significant issues with community members entering the Project site. However local herders and farmer F01 do use the Project area and its surroundings, so there is the possibility that Project construction and increased vehicle movements may pose a hazard to herders or their animals in and around the Project construction area.

Temporary labour influx of people (either for work, or with the hope to obtain work) can cause strains on local infrastructure, such as hospitals, markets and schools. Hospitals in particular are not well equipped, in particular to deal with incidents that may arise during the construction and operation of the Project. It can also put community members at risk of conflict with workers or at greater risk of contracting communicable diseases. The temporary labour workforce is expected to be EPC Contractor personnel and some Uzbek nationals from the region. It is expected that all EPC Contractor personnel will be house in on-site accommodation combined with offsite accommodation in Alat or further afield. The onsite accommodation will include a clinic and kitchen thereby reducing pressures on the local community. It is likely that any serious injuries will be transferred to Bukhara or further afield reducing the pressure on local health services.

Security guards are often the first point of contact between community members and the Project; therefore, they are the most vulnerable to conflict or harassment. It is unlikely that workers will bring their families given the short duration of the construction period. The likelihood of induced development as a result of the Project is low.

The introduction of workers in the vicinity of local communities has the possibility of increasing GBVH between workers and community members. However, this is considered to be unlikely due to the distance from the Project to the nearest communities, and the existing worker camps at the Khamza 1 and Khamza 2 substations, which have not caused such impacts, according to local community members.

There will be some groups within the local communities that will be more vulnerable to risks than others, or they may have difficulties in receiving Project benefits. These include women, disabled, elderly, illiterate and youths.

The community members at Kirlishon and Kulchovdur communities may be vulnerable to safety risks from increased construction traffic and other safety issues or construction nuisance (such as

dust and noise – are discussed in sections above). Other communities along the transportation routes for Project components may also be identified as at risk for transportation impacts (discussed in section 8.7).

8.11.4 Operation phase

There are no activities that will occur during the operations phase that will specifically impact community members, unless they attempt to access the Project infrastructure. This is unlikely due to the distance of local communities from the Project.

8.11.5 Decommissioning phase

CHSS impacts for the decommissioning phase will be similar to the construction phase and include the following:

- Project activities posing a hazard to local community;
- Temporary labour influx causing strain on local services;
- Poor worker conduct impact local community and in particular vulnerable groups e.g., women;
- Poor occupational health and safety in the workplace affecting worker wellbeing;
- Conflict between community members and security personnel could impact either or both parties; and
- Traffic and transportation of Project workers and removal of Project components could impact people living along the roadways.

8.11.6 Cumulative impacts

There are two other construction works being undertaken in the Project area, the Khamza 1 and Khamza 2 substation works that are being undertaken by the EPC contractors CNTIC and CNNC respectively. There have been no concerns regarding these other projects or their impacts, raised by local communities. However, there is a small chance there may be some community unrest if more migrant workers arrive in the area, with no visible project benefits (employment opportunities were specifically requested), for the local communities.

8.11.7 Summary of impact magnitude

Table 88 details the impact magnitude for the impacts identified above.

Table 88: Summary of magnitude – Community health and safety

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Construction						
Temporary labor influx leading to induced development	Low	1 to 16 months	Indirect AOI	Reversible	Low	Low

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Temporary labour influx leading to pressure on local infrastructure (health, accommodation)	Low	1 to 16 months	Indirect AOI	Reversible	Low	Low
Nuisance and health and safety impacts for workers at Khamza 1 and Khamza 2.	Medium	1 to 16 months	Indirect AOI	Reversible	Low	Medium
Community conflict with workers	Low	1 to 16 months	Indirect AOI	Reversible	Intermittent / Medium	Low
Poor worker conduct (inc. GBVH)	Low	1 to 16 months	Indirect AOI	Reversible	Intermittent / Medium	Low
Community conflict with security personnel	Medium	1 to 16 months	Indirect AOI	Reversible	Low	Medium
Safety risks for members of Kirlishon and Kulchovdur community members and herders (traffic)	Medium	1 to 16 months	Indirect AOI	Reversible	Intermittent	Moderate

8.11.8 Mitigation, management and monitoring measures

Table 89 outlines GIIP and feasible and cost-effective measures to prevent or minimise CHSS impacts during the construction, operation and decommissioning phases.

Table 89: CHSS mitigation and management

Project phase	Mitigation and management measures
Design/Contract	- Incorporate safety requirements into the project design. - Where necessary include fencing, safety signage (in locally used languages) and other relevant features to deter community members from entering the Project site.
Construction - Project Specific	- House workers from outside the project area or municipality in accommodation away from the immediate communities at Kirlishon and Kulchovdur as much as possible, thereby reducing potential social tensions and strain on community resources. - Prepare a plan/strategy to guard workers and community members against contracting communicable diseases. - Include in the traffic and transportation management plan (TTMP) (Volume IV, ESMP) measures to transport Project components as well as transportation of workers. - Include in the TTMP a disclosure plan for community members, to inform as to start of construction works and timing and Project impacts along the transportation route. - Employ local security guards and female guards where possible.

Project phase	Mitigation and management measures
Construction - GIIP	- Undertake a comprehensive stakeholder engagement campaign to inform community members of the possible risks and impacts of the construction of the Project (refer to SEP) including traffic, grievance mechanism, worker code of conduct, GBVH referral services etc. - Require all workers to sign a "code of conduct – workers". - Require all security personnel to sign a "code of conduct – security personnel". - Undertake cultural awareness training for migrant workers, should it be deemed necessary. - Prepare a Security Management Plan (Volume IV ESMP) that outlines the security requirements for construction and operations (including numbers of guards, whether they will be armed, use of video technology, training and background checks for guards etc). - Disclose the EPRP, to community members that may be impacted in an emergency or will be required to assist (emergency services) during and emergency. - Implement and disclose details of a community grievance mechanism which should include GBVH requirements. - Nominate a CLO for the construction and operations phases. - Determine whether training for community members on migrant workers, or communicative diseases is necessary, and implement if needed (to be determined by the CLO).
Operation and Maintenance	- Ongoing implementation of the SEP and grievance mechanism
Decommissioning	- As per construction phase
Enhancement	- Community Development Plan (to be prepared) with focus on health, education, water.
Monitoring	- Stakeholder engagement completed (stakeholder log) - Number of community grievances received (grievance log). Responses and follow up actions. - Periodic focus groups with community members to identify any impacts related to influx of people and put together mitigation measures, if identified. - Security incidence - Undertake OHS and emergency drills throughout construction and operations phases

8.11.9 Residual Significance

The residual significance post mitigation is summarised in Table 90. The assessment has indicated that CHSS impacts will not be significant.

Table 90: CHSS residual significance

Impacts	Magnitude (pre mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Temporary labor influx leading to induced development	Low	Medium	Low	Minor
Temporary labour influx leading to pressure on local infrastructure (health, accommodation)	Low	Medium	Low	Minor

Impacts	Magnitude (pre mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Nuisance and health and safety impacts for workers at Khamza 1 and Khamza 2.	Medium	Medium	Low	Minor
Community conflict with workers	Low	Medium	Low	Minor
Poor worker conduct (inc. GBVH)	Low	High	Low	Moderate
Community conflict with security personnel	Medium	Medium	Low	Minor
Safety risks for members of Kirlishon and Kulchovdur community members and herders (traffic)	Medium	Medium	Low	Minor

8.11.10 Data limitations and uncertainty

None identified.

8.12 Land

8.12.1 Potential impacts

The land required for the construction of the Project belongs to the Committee for Sericulture and Wool Industry Development (SWID). There are two existing Land Lease Agreements (LLA) that have been identified held by Buhoro Karakol Cluster LLC and subleased to "Alat Qorakolchilik" LLC, the organization that administers the land. In addition, a herder and his partner (Herder H1 and H2) have received a short term (10 month) agreement with the Alat Qorakolchilik LLC to graze animals on part of the Project stie.

A total of seven other community members (all from Kirlishon community V1-V7) unofficially (without written agreement from SWID) graze their livestock on and near to the Project site during the spring months (May to July). As a result of fencing off the Project site, these herders will have less area to graze their animals or will have to travel further to graze their animals.

Project activities with the potential to impact on the land use and involuntary resettlement include:

- Acquisition of the Project footprint by Masdar, resulting in:
  - Loss of land for SWID
  - Cancellation of short-term lease for Herders H1 and H1
  - Loss of grazing land on the project footprint for local community members V1-V7
- Construction activities and temporary land use removing access to grazing land.
- Removal of vegetation for the ROW of the OHTL impacting grazing.

8.12.2 Receptor sensitivity

The primary receptors for the Project are considered to be the herders (including herder H1 and H2 and community members V1-V7) that come from the Kirlishon community. Table 91 discusses the Project receptors for land impacts.

Table 91: Project land receptors

Receptor	Description	Sensitivity
Committee for Sericulture and Wool Industry Development (SWID), Buhoro Karakol Cluster LLC and Alat Qorakolchilik LLC	These are the official owner and administrators of the land. However, as these are all entities that are within the state framework of the wool industry development program, they are not likely to be sensitive to losing the Project land.	Low
Herder and his partner (H1 and H2)	These people are low income and use the land for their livelihood. Therefore, any impact to grazing land could be difficult for them to recover from.	High
Seven community members (V1-V7)	These people are low income and use the land for their livelihood. Therefore, any impact to grazing land could be difficult for them to recover from.	High

8.12.3 Construction phase

The owner of the land rights of the Project footprint, the access road and the OHTL tower is the government owned Committee for Sericulture and Wool Industry Development (SWID). The majority of the land is vacant pastureland that is being unofficially grazed by local community members (i.e., without a formal agreement). There is one short-term LLA for a herder and his partner (H1 and H2) to graze animals. Therefore, SWID and Buhoro Karakol Cluster LLC, as government entities are not expected to be impacted by the Project. Alat Qorakolchilik LLC is not expected to lose income as it leases land per head of livestock, rather than by area of land used, and its land lease agreement with herders H1 and H2 will remain in place.

The seven herders that graze animals on or near the Project footprint will experience some impacts as their grazing land overlaps the Project footprint; this is likely to result in a reduced area to graze animals, which could ultimately result in a reduction of livelihood (due to the herders having to pay additional money to reach alternative grazing lands, not being able to graze as many animals, or if the animal are not as healthy as prior to the Project, due to reduced grazing areas, dust etc.).

Additionally, the Project will need to get servitude rights over the land for the OHTL. The footprint of the OHTL towers will cause a permanent impact for the lifetime of the Project (however as the area covered by the footprint of the towers is relatively small, and vegetation can grow under the remainder of the OHTL route, it will be a small impact).

No use of medicinal plants, other ecosystem services or other untitled land use has been identified to date.

8.12.4 Operation phase

Access to grazing lands will remain restricted for the operations phase. However, no additional land acquisition will be required. Two possible areas of alternative grazing land have been identified by the Alat Qorakolchilik LLC for affected herders to use during the operation of the Project. Therefore, it is not expected that there will be any additional land impacts during operations.

Alat Qorakolchilik LLC confirmed its intention to support herder and local households with alternative land to ensure that their livelihoods will not be disturbed. As such, Alat Qorakolchilik LLC indicated two land plots nearby where herders H1 and H2 (under a new short term lease agreement) and local community members can continue grazing.

8.12.5 Decommissioning phase

Once all infrastructure has been decommissioned and removed from the site, the areas of permanent land take will be restored to their original state and returned to general grazing land, resulting in herders regaining the original amount of available land for grazing.

8.12.6 Cumulative impacts

There is no indication of any other projects ongoing or planned in the overlapping grazing areas or on land currently leased by the farmers. No cumulative impacts are expected in relation to land acquisition. SWID did not indicate any other large scale infrastructure projects connected with land under its management at this time.

8.12.7 Summary of impact magnitude

Table 92 details the impact magnitude for the impacts identified above.

Table 92: Summary of magnitude – Land

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Construction						
Loss of profit due to land take (SWID), Buhoro Karakol Cluster LLC and Alat Qorakolchilik LLC	Medium	Permanent	Direct AOI	No	High	Medium
Loss of livelihood due to restrictions on herding – herders H1 and H2 and local community members (V1-V7)	High	Permanent	Direct AOI	No	High	High
Loss of ecosystem services	Low	Permanent	Direct AOI	No	High	Medium

8.12.8 Mitigation, management and monitoring measures

Table 93 outlines GIIP and feasible and cost-effective measures to prevent or minimise land acquisition impacts during the construction phase.

Table 93: Land acquisition mitigation and management

Project phase	Mitigation and management measures
Design/Contract	- As far as possible/practical undertake Project design to avoid all structures, crops and trees. - Prepare a Livelihood Restoration Plan (LRP) (Volume IV, ESMP) that defines the responsibilities of the Project in relation to land acquisition and resettlement. - Complete all land acquisition and resettlement requirements per the LRP prior to the commencement of construction.
Project Specific	- Confirm with herders if there is sufficient area to graze their animals away from the Project construction works. - Work with SWID, Buhoro Karakol Cluster LLC and the Alat Qorakolchilik LLC, to identify alternative land for herders (ongoing process, refer to LRP for outcomes). - Confirm any possible employment impacts to herder employees (none identified to date).
Good International Practice	- Include herders in all relevant consultations and information disclosures as per the Project SEP. - Design grievance mechanism to be implemented and disseminate in a culturally appropriate way to herders. - Prepare a livelihood restoration completion report to prove that required activities have been completed within the timeline of the LRP. - Undertake livelihood restoration activities with all impacted households (herder households).
Operation and Maintenance	- Ongoing access to alternative land for grazing.
Decommissioning	- Land restoration plan to ensure land is restored in a manner that is suitable to expand grazing area following removal of all infrastructure. To be addressed in the decommissioning impact assessment planned to be performed at the time.
Enhancement	- Refer to no-net loss mitigation outlined in section 8.8 for improved grazing land.
Monitoring	- Number of community grievances received related to land or grazing. - Monitor livelihood restoration of impacted households for at least three years to ensure they have at least returned to their previous level of livelihood, if not improved their livelihood. - Monitor the implementation of livelihood restoration activities.

8.12.9 Residual Significance

The residual significance post mitigation is summarised in Table 94. The assessment has indicated that land acquisition impacts will not be significant.

Table 94: Land acquisition residual significance

Impacts	Magnitude (pre mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Loss of profit due to land take (SWID), Buhoro Karakol Cluster LLC and Alat Qorakolchilik LLC	Medium	Low	Low	Neutral

Impacts	Magnitude (pre mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Loss of livelihood due to restrictions on herding - herders and employees	High	High	Low	Moderate
Loss of ecosystem services	Medium	Low	Low	Neutral

8.12.10 Data limitations and uncertainty

None identified.

8.13 Cultural heritage

8.13.1 Potential impacts

While the Bukhara region (particularly the city of Bukhara) is known for its UNESCO World Heritage Sites, no items of intangible cultural heritage as listed in the UNESCO World Heritage List are located within the Project site. The Agency of Cultural Heritage has confirmed that no items registered under state protection are located in the Project area or within a 500 meters radius of it, and consultations with the Alat District Khokimiyat and local communities did not identify any items of cultural significance to the local communities located in or around the Project footprint.

The Institute of Archaeology found some possible items of cultural heritage during their assessment of the site. However, these were removed and the land on which they were found was determined not to have historical significance. Therefore, it is possible, but not likely that items of cultural heritage will be identified during Project excavation works.

8.13.2 Receptor sensitivity

Receptors in relation to cultural heritage are summarise below.

Table 95: Project cultural heritage receptors

Receptor	Description	Sensitivity
Unidentified cultural heritage in the Project footprint	Only possible during excavations, which will only occur during construction. Based on current findings, the significance of these finds is expected to be low.	Low
Known cultural heritage in the Project footprint	Items were found, but removed and the land was determined not to be of cultural significance.	Low

8.13.3 Construction phase

Unexpected items of cultural heritage or paleontological significance are most likely to be identified during site preparation and excavation or other earth works. Site preparation and excavation work is only expected during the construction phase and will take place in the construction of office buildings, for the erection of the PV panels, for the erection of the OHTL towers and the digging of trenches for drainage etc.

Given Uzbekistan's cultural past, and the fact that many previous cultures were nomadic, there is a possibility that further items, not previously identified (referred to as "chance finds"), may be identified during the excavation works.

8.13.4 Operation phase

During the operations phase no below ground works are anticipated. Maintenance works for the Project are not expected to impact items of known or unidentified cultural heritage.

8.13.5 Decommissioning phase

During decommissioning no below ground excavation works in areas not previously surveyed is expected.

8.13.6 Cumulative impacts

No cumulative impacts are expected in relation to cultural heritage.

8.13.7 Summary of impact magnitude

Table 96 details the impact magnitude for the impacts identified above.

Table 96: Summary of magnitude – Cultural heritage

Activity	Intensity / compliance	Duration	Spatial Extent	Reversibility	Likelihood	Magnitude (pre-mitigation)
Construction						
Impact on known cultural heritage	Low	1 to 9 months	Direct AOI	No	Low	Low
Impact on unidentified cultural heritage in the Project footprint	Medium	1 to 9 months	Direct AOI	No	Low	Medium

8.13.8 Mitigation, management and monitoring measures

Table 97 outlines GIIP and measures to prevent or minimise cultural heritage impacts during the construction phase.

Table 97: Cultural heritage mitigation and management

Project phase	Mitigation and management measures
Design/Contract	- Include requirement for a chance finds procedure in the Project contract. - EPC Contractor to employ a local archaeologist to supervise excavations works (per the requirements of the institute of Archaeology)[136]
Project Specific	- Maintain communication with the Institute of Archaeology on the requirement to contract the archaeologist.

[136] The identification of a suitably qualified archaeological team can be undertaken with the support of, or in coordination with, the local authorities/mahalla or khokimiyat.

Project phase	Mitigation and management measures
	- Require the EPC Contractor to hire the archaeologist from the Institute of Archaeology under the Academy of Sciences of Uzbekistan[137].
Good International Practice	- Establish a chance find procedure (that includes national and Lender requirements as well as following GIIP) for the construction phase, or any phase that requires excavation works. - Should items of cultural heritage be identified they should be managed in line with the chance find procedure and the Institute of Archaeology should be notified. - Carry out ongoing discussion with local community members in relation to the cultural significance of the site.
Operation and Maintenance	- Not relevant
Decommissioning	- Not relevant (subject to outcomes of the construction phase works)
Enhancement	- Train workers in the identification of items of cultural heritage or archaeological significance.
Monitoring	- Log and report all chance finds identified. - Should items of cultural heritage be found on or near the Project site, these should be regularly monitored to ensure they are properly signposted, their buffer zones are maintained and that no harm has come to the items. - Training should be provided to workers on the location of such items and the proper behaviour around the items of cultural heritage.

8.13.9 Residual Significance

The residual significance post mitigation is summarised in Table 98. The assessment has indicated that cultural heritage impacts will not be significant.

Table 98: Cultural heritage residual significance

Impacts	Magnitude (pre mitigation)	Sensitivity	Magnitude (post mitigation)	Residual significance (post mitigation)
Impact on known cultural heritage	Low	Low	Low	Neutral
Impact on unidentified cultural heritage in the Project footprint	Medium	Low	Low	Neutral

8.13.10 Data limitations and uncertainty

None identified.

[137] According to local laws, only one archaeologist (or one team of archaeologists) is allowed to investigate an area at a time, and the permit is valid for one year. During the period of the permit, other archaeologists cannot carry out research work on the same territory. Therefore, the archaeologists who conducted the survey in 2023 will need to be hired (the archaeologist from Institute of Archaeology under Academy of Sciences of Uzbekistan).

9 Environmental and Social Management and Monitoring

9.1 Overview

An ESMP (Volume IV) is prepared as part of the ESIA to support the ongoing implementation of E&S requirements for the Project. The objectives of the ESMP are to:

- Clearly describe the required components of the Masdar/Project Company and EPC Contactor and subcontractor environmental and social management systems (ESMSs) for the construction and operation phase.
- Provide overview of the Masdar/Project Company structure and roles and responsibilities for implementing projects.
- Define the supporting management plans require for implementing the requirements of the ESIA.
- Confirm compliance obligations.
- Establish objectives of the ESMP (construction and operation).
- Define roles and responsibilities for implementation of the requirements of the ESMP.
- Set minimum requirements for meetings inspection, audits and reporting.
- Define key performance indicators (KPIs).

A summary of the key commitments outlined in this ESIA is provided in the ESMP. These will be elaborated in the subsequent supporting management plans to provide further information on:

- Outcomes or targets
- Timeframes
- Responsibilities
- Resources required.
- Monitoring activities

The Project Company will adopt a Project E&S Policy (provided in Volume IV ESMP) and work under the Masdar construction environmental and social management system (cESMS) and operational ESMS which is aligned to (but not certified to) ISO 14001 and 45001 (for health and safety). In addition, the E&S Policy commits to working in accordance with IFC PSs and ADB SPS 2009.
The EPC Contractor is required to hire an HSSE Manager, Deputy HSE Manager, E&S Supervisors, International and Local E&S Advisors, Community Liaison Officer. The EPC Contractor will also be required to develop a Construction Environmental and Social Management System (CESMS) prior to the start of construction, incorporating all necessary policies, procedures and plans required within the Project ESIA, using Masdar's construction ESMS PV Template' documentation as a reference starting point. Following lender / IESC approval of CESMS, translate key mitigation control tables within all E&S management plans into Uzbek language, in order for its easier implementation by the Project EPC and the subcontractors. General E&S documents required for

development for construction phase include the following:

- Project ESMS Manual
- Permits Register
- E&S Training Management Plan
- Site Mobilization Plan
- Topic Specific management plans as defined in the ESMP

The Project Company and EPC Contractor will adopt a robust human resource policy, local hiring policy and supply chain policy.

The O&M Contractor will shall develop an Operational Environmental and Social Management System (OESMS) and supplementary management plans, which will address relevant E&S risks.

The E&S provisions and obligations in the main contract between the Project Company and EPC contractor and O&M contractor must be applied back-to-back down the sub-contracting chain.

The ESMP requires an emergency preparedness and response plan to be prepared that considers natural hazard risks (e.g., flood risk, seismic risk, weather risk) in project design), climate related risk, the proximity and availability of adequate medical services and risk management and training protocols. In determining the suitability of nearby medical services and the needs for supplemental services on site in the form of a capacity assessment. The capacity assessment will form the emergency preparedness and response plan.

10 Conclusions

10.1 Key conclusions

The Project is considered to be suitable for development and able to comply with national regulatory framework and the requirements of IFC PSs and GIIP.

The project can be developed in accordance with:

- PS1 – Assessment and Management of Environmental and Social Impacts and Issues
- PS2 – Labour and Working Conditions
- PS3 – Resource Efficiency and Pollution Prevention and Control
- PS4 – Health, Safety and Security (community/workers)
- PS5 – Land Acquisition, Involuntary Resettlement; and Economic Displacement; and
- PS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources.

PS 7, PS 8 are not considered to be triggered.

This ESIA has identified and evaluated potential environmental and social impacts that the Project may have on the environment and communities within its AOI (positive and negative) and reached the following conclusions.

The measures outlined in this ESIA enable the Project to avoid, or where avoidance is not possible, minimise, mitigate or compensate adverse environmental or social impacts and issues to workers,

affected communities and persons, and the environment from Project activities, including biodiversity impacts to acceptable levels.

Overall, the ESIA concludes that the Project represents a priority infrastructure for Uzbekistan. The Project is an effective and viable energy infrastructure project for the country.

10.2 Stakeholder engagement

- A systematic approach to stakeholder engagement has been employed that has sought to build a constructive relationship with stakeholders, particularly the directly affected communities.
- Stakeholder engagement and consultation has been performed throughout the ESIA process as defined in the SEP (Volume V) and summarised in Section 5.
- The public meetings held to disclose the draft ESIA, have demonstrated the communities have few concerns regarding the Project and consider possible employment opportunities to be the biggest direct benefit to the community (community members were informed that the number of possible job positions for local communities was low). To date, stakeholder perception of the Project is broadly positive.
- A program for effective engagement going forward is set out in the Project Stakeholder Engagement Plan (SEP) alongside a project community grievance mechanism.

10.3 Environmental

- The Project is susceptible to climate related risks on physical infrastructure and worker health which can be managed through climate resilient design choices and appropriate emergency response planning.
- Sustainable land clearance practices and rehabilitation and restoration actions are required to ensure disturbed areas of land are not degraded with the potential for erosion and loss of habitat.
- The Project may generate negative environmental impacts from the use of hazardous materials, or poor waste management, however these can be mitigated or managed to acceptable levels.
- The Project will have a negligible impact on AQ, noise, groundwater, and water availability, cultural heritage and transportation infrastructure in the local region.

10.4 Biodiversity

- The project is not predicted to adversely impact on any national or international protected areas.
- No features were identified as Critical Habitat triggers for the Project (refer also to ESIA Volume III: Technical Appendix – Critical Habitat Assessment.
- Twenty distinct biodiversity features have been identified as Priority Biodiversity Features (PBFs) or Natural Habitat (NH) feature.
- Potential impacts on a possible PBFs or Natural Habitat features (20) are considered to have a residual significance of moderate or less.

- No-net loss management plan for (*Calligonum matteianum, C. molle, C. paletzkianum*) and general habitat loss will be developed.
- Biodiversity impacts with the highest potential impact (moderate) include habitat loss or disturbance to PBF species including Goitered Gazelle, Central Asian Tortoise, Macqueen's Bustard, two duck species, four fish species, Central Asian Tortoise, Central Asian Otter) and potential for waterbird collision with powerlines.
- Habitat restoration aligned with the principles of no-net loss will present added opportunity to enhance habitat for certain PBFs and Natural Habitat features as listed above.

10.5 Labour and social

- Occupational health and safety risks will require a comprehensive construction health and safety management system and occupational health and safety plan for the Project works.
- Labour matters and supply chain matters which are crucial to the successful development of the Project will be managed by setting out key obligations on suppliers and contractors in contractual documentation.
- Local employment and procurement will be prioritised where possible. However, awareness raising will be necessary in the local communities to manage expectations of the exact number of opportunities available.
- Cumulative impacts of community unrest (or lack of support for the project) could occur if expatriate workers are selected to work on the project and communities consider that employment opportunities for local community members are insufficient.
- Temporary worker accommodation requirements will be managed by ensuring housing standards are aligned with GIIP as defined by the EBRD and IFC Guidance on worker accommodation and any additional standards required by other Lenders.
- Community health and safety risk are deemed to be low however the Project will implement awareness raising activities to inform local community members of the outcomes of the findings of the ESIA.
- All workers (including security personnel) will be required to sign a workers' code of conduct that includes obligations for recognising the potential for GBVH risks exacerbated by the Project.

10.6 Land

- The Project will not result in any physical displacement impacts.
- There will be some permanent and temporary land take for the Project that may result in adverse impacts on the livelihoods of local herders.
- Livelihood impacts are not expected to be significant and livelihood restoration measures are outlined in the Project LRP to address loss of access to land by herders. This includes availability of alternative neighbouring land for grazing.