Environmental and Social Impact Assessment

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Uzbekistan: Samarkand I Solar PV and BESS Project

PART 2

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7 WASTE AND WASTEWATER MANAGEMENT

7.1 Legal Requirements and Standards

7.1.1 National laws and regulations

7.1.1.1 The national law on waste management (2002, amended in 2019)

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

- Article 19 states that 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.

7.1.1.2 SanPiN no. 0127-02 on sanitary procedures for inventory, classification, storage, and disposal of industrial wastes

These regulations and standards require the proper management and inventorying of industrial waste, and the classification of industrial waste by hazard, to its suitability for re-use, recycling, treatment and disposal.

7.1.1.3 The SanPiN no. 0128-02 on the classification of toxic industrial wastes

These regulations provide for the categorization of hazardous waste according to pre-defined hazard classes, which include:

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

7.1.1.4 Other relevant legislation

Other national regulations and standards include the following:

- 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.

7.1.2 Lender requirements

7.1.2.1 ADB

The SPS requires the borrower/client to avoid, or where avoidance is not possible, to minimise or control the generation of hazardous and non-hazardous wastes and the release of hazardous materials resulting from project activities. Where waste cannot be recovered or reused, it must be treated, destroyed, and disposed of in an environmentally sound manner.

Where the waste disposal is conducted by third parties, the borrower/client is required to use reputable and legitimate enterprises licensed by the relevant regulatory agencies.

7.1.2.2 IFC and EPFIs

The World Bank General EHS Guidelines (2007) establish general requirements for direct or indirect discharge of wastewater from utility operations or storm water to the environment. Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment.

However, wastewater effluent pollutant limits are only established for sanitary wastewater for discharge to the sanitary sewer systems. World Bank General EHS Guidelines (2007) (ref. Table 1.3.1 of IFC EHS Guidelines) provide indicative values for treated sanitary wastewater effluent.

7.2 Baseline Conditions

7.2.1 Administration of waste management infrastructure

The Ministry of Ecology, Environmental Protection and Climate Change (MEEPCC) is the overarching authority responsible for the regulation of waste management and the development of waste management infrastructure in Uzbekistan. The Ministry collaborates with the Republican Association of Specialized Enterprises for Sanitary Cleaning (RASESC) in administrating waste management services at the regional level. The responsibility for collection and transportation of domestic, municipal, and industrial waste for treatment and disposal at strategic waste facilities is devolved to 'Toza Hududs', which operate as 'State Unitary Enterprises'. Each regional Toza Hudud has district-level branches, which coordinate the collection, transfer, and disposal of waste from various service areas. Qishloqkimyo is a state agency entrusted with the transportation and disposal of hazardous materials in Uzbekistan, particularly those within the agricultural sector.

Given the dearth of public waste collection, treatment, recycling, and disposal facilities in certain parts of Uzbekistan, the private sector has a growing involvement in waste management services, through Public-Private Partnerships (PPPs). Toza hududs (regional waste utilities) and commercial waste collection contractors charge tariffs, which vary according to the class and quantity of waste conscriptions. The reach of waste services is limited in certain rural areas, where public waste collection machinery and equipment are less available, and the affordability of service fees is relatively low.

7.2.2 Local waste management and sanitation

The ESIA involved Key Informant Interviews (KIIs) with regional and district-level khokimiyats and Focus Group Discussions (FGDs) with affected communities, to gain information regarding waste management within affected communities and their wider respective districts. These consultations revealed that while municipal waste is typically collected by Toza Hudud, solid waste collection services are not available within some of the residential communities located nearby the project sites.

The majority of residents within the project-affected communities are also not connected to centralized sewerage systems for the disposal of domestic wastewater.

Communities without access to waste collection services reported the following means of waste disposal:

- Septic tanks
- Composting and 'backyard waste pits'
- Open burning of solid waste

- Reuse of kitchen waste as livestock feed

The following table provides an overview of the main waste management facilities and services providers within the project-affected districts and regions at large.

Table 7-1 Overview of waste management facilities and service providers within the project-affected region

REGION	MUNICIPAL WASTE MANAGEMENT FACILITIES
Samarkand	Waste management services within affected communities are provided by (i) Toza Hudud and (ii) a commercial contractor, namely Gold Marjonabegim LLC. • Kylichli (engineered) landfill is used for the disposal of general waste. • Sazagan and Qayirmasoy (engineered) landfills are used for the disposal of hazardous waste. • Wastewater treatment plants include the Main Samarkand WWTP, Geofizika WWTP and Farhad WWTP.

7.3 Receptors

The following table provides an overview of E&S impact receptors in the context of waste management within the Project's Areas of Influence (AoI). A sensitivity rating and corresponding description is provided for each relevant receptor.

Table 7-2 E&S impact receptors – Solid waste and wastewater

RECEPTOR	SENSITIVITY	JUSTIFICATION
Project workers	High	Project workers have a potentially high sensitivity to impacts on human health, which can result from the mismanagement of solid waste and wastewater from activities in the Project's construction, operational and decommissioning phases.
Local communities	High	Affected communities based nearby the PV plant, and BESS sites have a potentially high sensitivity to impacts on human health, which can result from the mismanagement of solid waste and wastewater from activities in the Project's construction, operational and decommissioning phases.
Municipal and commercial waste management contractors within the project-affected districts and region	High	Existing waste management facilities in the project-affected districts and the wider Samarkand region have a potentially high sensitivity to an overwhelming cumulative demand for services, due to the limited availability and capacity of these facilities.

7.4 Potential Impacts and Management Measures

7.4.1 Construction phase

7.4.1.1 Solid waste

During the Project's construction stage, waste will be generated from earthworks, civil works, electro-mechanical works, electrical installations, among other activities. Typical construction wastes include concrete, asphalt, scrap metal, glass, plastic, wood, packaging materials, excess cables, and domestic waste from construction workers. Concrete may be found in two forms on the construction site; structural elements containing reinforced concrete, and non-reinforced concrete found in foundations (such as surface level concrete slabs).

Solid waste generated from construction activities on the project sites will include the following:

(i) Non-hazardous waste, potentially including:

- Waste related to construction processes, including earthworks (such as rubble, soils and potentially rock), installation (such as bolts, rebars, etc);
- Paper/cardboard, plastics, packaging, plastic bottles, glass, scrap metal, excess fill materials, sand, gravel, excess construction materials, concrete, subsoil and rock (not contaminated)
- Domestic waste generated by the construction workforce (e.g. food/organic waste, paper trash, cardboard, aluminium, plastic)

(ii) Hazardous waste, potentially including:

- Batteries (unused), chemical drums, aerosol cans, contaminated metals, empty containers, expired and unused chemicals, adhesives, machinery lubricants, clean-up materials such as rags, containers, and tins with remains of hazardous substances, used spill kits and clean-up materials.
- Replacement parts from vehicles, plant, and equipment such as tyres.
- Residual materials from electrical equipment installation such as Waste Electrical Equipment (WEE)

A substantial amount of waste will be generated in the Project's construction phase. Inappropriate handling, storage, transport and/or disposal of solid waste streams during construction poses the potential for pollution of the surrounding environment (i.e. soil and groundwater resources), odour and visual nuisances, pest infestation and related occupational health and safety risks.

Given that the construction of the BESS will involve the assembly of prefabricated components, the amount of solid waste that will be generated on the BESS site will be lower. However, potentially inappropriate handling, storage, transport and/or disposal of these solid wastes also poses the potential for pollution of the surrounding environment.

Note: Major maintenance services for construction machinery and vehicles will not be provided within the project sites, and the generation of associated vehicle related waste such as oil filters, spent filtration cartridges, and machinery lubricants is therefore not expected.

NON-HAZARDOUS SOLID WASTE

Non-hazardous construction waste is typically inert and does not pose a threat to human health or the environment. However, proper management is required in order to reduce associated secondary impacts such as unnecessary resource use, dust emissions, etc. Non-hazardous waste generated by the Project will be collected by a licensed waste contractor and transported to a licensed waste management facility.

HAZARDOUS SOLID WASTE

Due to the nature of the project and the construction works being undertaken, there will be a few hazardous materials used. Such materials potentially include oily residues, paints, paint cans, wastes from chemical cleaning products and containers used for the storage of these materials.

Although the hazardous fraction of construction waste is expected to represent a relatively small portion of the total amount of construction waste likely to be generated, its management requires careful consideration as the impacts associated with hazardous waste can potentially result in contamination to soils and potentially groundwater, as assessed in Section 6 of this Report.

Inappropriate management, storage, handling, transfer or transportation of waste and the lack of personnel training on site may lead to accidental spills or leaks to the soil or groundwater resulting in environmental impacts and potential health risk to workers. Contamination events may also arise as a result of transportation by unlicensed waste contractors or disposal to unlicensed/unauthorised landfills. Waste management strategy and planning is therefore critical in order to minimise potential significant effects on sensitive receptors such as soil and groundwater.

Most of the project facilities are located within sites that are situated a long distance away from major hazardous waste landfills. Therefore, it will be particularly important to properly store the waste in designated and secured hazardous waste storage facilities on construction sits, until its collection to final disposal. These areas will include bunds to contain spillages, secure fencing to control access, proper safety signage, and roofing to prevent rainwater ingress and heating.

In addition, the EPC Contractor will be required to coordinate with the local government to identify suitable, licensed waste disposal facilities and waste transfer and/or disposal service

providers. Solid waste streams likely to be generated within the construction phase of the project are specified in the table below.

Table 7-3 Anticipated Solid Waste Types Associated with the Construction Phase

TYPE	WASTE STREAM
Inert	Subsoil and rock
	Glass
Non-Hazardous	Concrete and cement
	Asphalt
	Scrap metal
	Wood
	Plastic
	Packaging
	Domestic waste from construction workers
Hazardous	Contaminated soil/asphalt
	Resins and paints
	Waste oils
	Waste solvents and thinners
	Waste fuel and chemicals.
	Batteries
	Used spill kits and clean up materials.
	Waste Electrical Equipment (WEE)

7.4.1.2 Liquid Waste/Wastewater

Wastewater generated from the Project's construction activities will include the following:

- Sanitary and domestic wastewater generation
- Wastewater from any vehicles or equipment washing/cleaning
- Liquid hazardous waste such as fuels, chemicals, paints, lubricants, solvents, waste oil, hydraulic fluid, resins, waste solvents and thinners, etc.; and.
- Concrete washout, in the event that a concrete batching plants are installed on the PV plant and BESS sites

For sanitary and domestic wastewater, it is anticipated that there will be a significant number of workers at the peak period of construction. The annual amount of sanitary and domestic wastewater during construction will total about 84,503 litres. Improper handling, storage and transportation of sanitary and domestic wastewater could potentially cause contamination to soil or groundwater resources as assessed in Section 6.5 of this Report.

Municipal and/or commercial waste management contractors will be engaged for the collection, transfer and disposal of wastes generated within construction sites. Suitable,

licensed entities and facilities for the management of different construction waste streams were not identified at the time of this assessment. The EPC Contractor will liaise with local authorities to identify the most suitable service providers and facilities prior to the commencement of construction activities.

7.4.2 Operational Phase

The Project's operational phase will entail a lower rate of waste generation from limited O&M activities and a relatively smaller workforce. Further, operational waste will largely comprise non-hazardous, recyclable waste. Nevertheless, inadequate facilities, procedures and contingency safeguards for the storage, collection, transfer, treatment/ recycling and/or disposal of O&M waste pose the risk of contamination of ambient soil, groundwater and surface water, and resultant impacts on human health and sensitive ecology within receiving environments.

NON-HAZARDOUS WASTE

The operation of the proposed Project will generate small amounts of non-hazardous solid waste from the operation of O&M offices and sanitation facilities, which will include recyclable fractions. Recyclable solid waste potentially includes paper, tin cans, plastic, cartons, rubber, and glass, while non-recyclables will consist of scrap food and other organic wastes. Other non-hazardous waste streams will include packaging, landscaping, and maintenance waste.

Non-hazardous wastewater (i.e., blackwater and grey water) will also be generated from sanitary activities within office kitchens and toilets. The spillage of sewage from on-site sewage pipework, chambers and septic tanks can result in the contamination of ambient soils, groundwater, and surface water, and thereby impact on human health or cause eutrophication within receiving aquatic habitats. All sanitary streams should therefore be directed towards the septic tank for collection and disposal by a licensed contractor.

HAZARDOUS WASTE

The following hazardous solid waste streams will be generated in limited quantities, at the Project's operational stage:

- Electronic waste (defective and exhausted PV modules, battery units, etc.)
- Used containers for hazardous chemicals/ waste
- Contaminated spill response materials (e.g., spill kits, etc)
- Soil contaminated by potential spills and leaks of hazardous materials/liquids
- Contaminated runoff and wash-water

In addition, hazardous liquid waste from O&M activities and contingencies potentially include the following:

- Used oils from major transformer maintenance
- Contaminate runoff and wash water
- Contained, spilled fuels, chemicals, paints, lubricants, solvents, waste oil, hydraulic fluid, resins, waste solvents and thinners

Inappropriate segregation, storage, transfer and final disposal of hazardous waste streams pose the risk of accidental release of hazardous waste into the environment, resultant contamination of ambient soils, groundwater and surface water, and associated impacts on human health and sensitive biodiversity within receiving environments.

Mismanagement of hazardous O&M waste streams can arise from lacking delivery induction and refresher trainings to O&M workers, unauthorized transfer and disposal of such waste to undesignated third-party facilities by direct workers (including haphazard waste dumping), as well as the engagement of unlicensed service providers for waste collection, transport, treatment and disposal.

7.4.3 Decommissioning phase

The Project's decommissioning activities will generate inert demolition waste and materials such as steel reinforced bars, broken concrete, cabling, transformer oils etc. to contaminate soils.

Prior to decommissioning, it is expected that all oils will be drained. This will minimize the risk for accidental spills and leaks during removal from equipment from the site, as transformer oil and other oils are classified as hazardous liquid waste and will therefore be collected for recycling and/or disposal by a licensed contractor.

The decommissioning of the PV power plant and BESS infrastructure provides significant opportunity for material re-use and recycling. All demolition work will be carried out with reference to IFC EHS Guidelines 1.6 Waste Management, IFC EHS Guidelines 1.5 Hazardous Materials Management, and IFC PS3 on Resource Efficiency and Pollution Prevention.

The O&M Contractor will be responsible for the management of recyclable and re-usable operational and decommissioning waste, using specialized and licensed internal and/or third-party facilities. Locally available waste management facilities appropriate for material recovery will be prioritized. Where capacity for the re-use and recycling of operational and decommissioning waste and electronic refuse in particular is not available for economically viable transportation and disposal, waste management facilities designated by local

authorities will be utilized for final disposal, whilst ensuring that hazardous waste is disposed within facilities specialized (engineered) for this waste stream, exclusively.

7.5 Mitigation and Management Measures

7.5.1 Waste Characterization

Waste can exhibit certain characteristics according to the process stream from which it is generated and any pre-treatment processes that are undertaken. Different types of waste require different management and disposal techniques according to the potential risk that the material poses to human health or the environment. For this Project, waste has been classified into three (3) main categories below.

Table 7-4 Waste Characterization

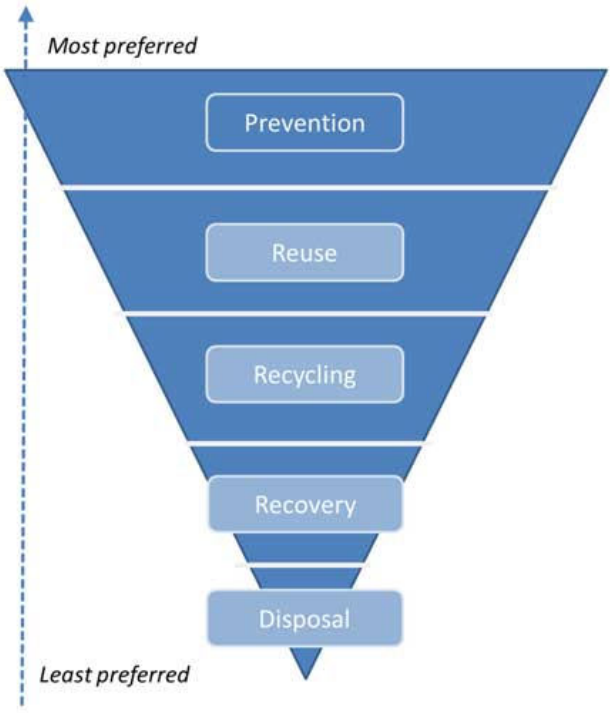
WASTE CLASSIFICATION	DESCRIPTION
Domestic Waste	Household, commercial, agricultural, governmental, industrial and institutional wastes, which have chemical and physical characteristics similar to those of household such as garbage, paper, cardboard, plastic, cans, etc. Disposal of such waste can generally be routed to municipal recycling or disposal facilities
Industrial Waste	Non-hazardous wastes that have physical and chemical characteristics that are different from domestic wastes such as construction waste, glass, scrap metal, wood, used containers, tyres etc. This waste generally poses little risk to the environment and can be disposed to normal municipal facilities after waste minimisation options are exhausted and before obtaining approval
Hazardous Waste	Waste is classified as being hazardous because of its concentration; physical, chemical or infectious characteristics, which may pose a present or potential threat to human health or the environment and/or may cause an increase in serious irreversible or incapacitating reversible illness or contribute to an increase in mortality. Under DM guidelines and the Basel Convention, hazardous waste is as any waste (i.e. solid, liquid or gaseous) having the following properties: Explosive; Radioactive (which includes NORM (LSA) scale); Ignitable or flammable substances; Poisons with acute and chronic (delayed) toxicity; or Substances that by interaction with water might become spontaneously flammable or give off flammable gases. Hazardous waste must be segregated, stored, transported and ultimately treated and disposed of by an approved waste services provider.

7.5.2 Waste Management Hierarchy

The waste hierarchy illustrates good practice for waste management considerations by ensuring consideration of the most sustainable available application for waste management in preference of disposal and eventual contribution to adverse environmental and economic impacts associated with landfill. The hierarchy as illustrated below should form a key element

of any waste management strategy and if implemented effectively will achieve maximum reductions on waste quantities combined with the limited use of resources and fill space. The waste management hierarchy also has the potential to reduce costs that may be incurred by the main contractor or the proponent for handling, transportation, and the disposal of waste.

Figure 7-1 Waste Hierarchy



Source: *United Nations Environment Programme*

Initially, options to prevent or reduce waste should be considered. Where waste generation cannot be avoided or further reduced at source, opportunities for reuse of materials should be explored, either for use for the same or a different purpose. Disposal to landfill is the least favored option in the waste hierarchy and is the last resort after all other options have been considered.

Such an approach is also used in other areas of the world. US-EPA's Waste Minimization Program presents the following objectives:

- Complete elimination of, or substitution for priority chemicals, wherever possible
- Minimizing the number of priority chemicals used whenever elimination or substitution is not possible
- Maximizing recycling whenever elimination, substitution, or minimization is not possible, creating closed-loop materials management systems that eliminate or constrict release pathways
- Promoting cradle-to-cradle waste management instead of cradle-to-grave waste management

7.5.3 Construction Phase

Table 7-5 Waste & Wastewater Mitigation and Management Measures - Construction

IMPACT/SOURCE	MITIGATION AND MANAGEMENT MEASURES
Inappropriate handling, storage, transport and disposal of solid non-hazardous waste	• The project will develop and implement a Project specific Construction Waste Management Plan (CWMP) in line with committed mitigation measures in this ESIA report and the provisions of the CESMP. • Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling and reuse. • Waste containers/skips will be clearly labeled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages (such as Uzbek and Russian) as required for the workforce. • For litter (food waste, domestic waste), an adequate number of covered bins will be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. • Food waste must be stored within a sealed metal or plastic skip or bin, in order to prevent pests gaining access. • On-going housekeeping training will be provided to all staff on the importance of the need to avoid littering. • Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all lightweight material that could be blown away. • Waste generated during construction will be recycled and reused until reduced to as low as practicable prior to collection for disposal by an appropriately licensed waste contractor. • Only licensed waste transporters and waste management facilities will be engaged. • Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments • Completed waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal. All records will be maintained on site. • Mandatory training program for employees to increase their awareness of waste management protocols including proper handling and storage of waste, recycling waste, reusing plastics, rebar, wood & other reusable non-hazardous materials. • EPC Contractor will identify recycling companies in Samarkand Region, and nearby regions (as relevant) in order to promote the recycling of waste especially packaging materials, wood and metal waste etc. • Engineered landfills will be used for all hazardous waste generated during construction and used for the disposal of non-recyclable general waste on a priority basis.
Inappropriate/un controlled handling, storage, transport and/or disposal of solid hazardous waste	• Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments. • Segregate and identify hazardous waste from the other waste streams into separate signed and labeled waste containers/skips.

Impact/Source	Mitigation and Management Measures
	• Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition. • Hazardous waste storage area will be constructed away from drainage systems and a rain shelter will be provided to avoid any potential instance of runoff, or leakage of runoff. • Waste containers will be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce (such as Uzbek and Russian). Wherever possible, chemicals will be kept in their original container. • Hazardous waste storage areas will be located away from any ignition sources or fire hazards. • Used face masks will be stored in designated bins and disposed of as medical waste. • A Hazardous Materials and Waste Management Plan will be developed and implemented for the Project's construction phase. The Plan will include arrangements and provisions (i.e., storage area/capacity, frequency of collection, distance of nearest disposal facilities) for various streams of waste, in consideration of the location of their respective management/ disposal facilities.
Inappropriate/un controlled handling, storage, transport and/or disposal of sanitary wastewater	• Contractor to develop and implement a Project Specific Construction Waste Management Plan (CWMP) in accordance with committed mitigations measures in this ESIA report and provisions of the CESMP. • Develop and maintain a hazardous waste inventory to document and track sanitary waste generated and segregated. • Sanitary wastewater tanks will be placed in allocated impervious hard standing areas with bonding capacity to hold 110% volume of the maximum volume stored. • Sanitary wastewater tanks to be properly maintained and inspected to ensure tanks do not overflow. • Site inspections will be carried out regularly by the EPC contractor to ensure that all wastewater generated is properly managed, and no leakages or spill occur. In the event of a spill or overflow, immediate action will be taken in accordance with spill containment procedures and clean up procedures (to be developed in line with the CESMP). • Engage a licensed waste contractor for the periodic removal of septic tanks. • In common with the IFC EHS Guidelines, effort will be made in training construction personnel to minimize water consumption for ablutions and to ensure an understanding of water resource and wastewater issues.
Inappropriate handling and disposal of contaminated soil from clearing and excavation works causing cross-	• In-situ testing of soil to ensure it is not contaminated and can be re-used or disposed into land. • Training –Contractor staff to be able to identify signs of potential contamination (smell of hydrocarbons, staining). • If contamination is found, develop and implement a Contaminated Soil Management Plan for appropriate handling, treatment and disposal of soil.

Impact/Source	Mitigation and Management Measures
contamination of soils	
Inappropriate handling of concrete washout	• In case a concrete batching plant will be installed on construction sites, concrete washout will only be undertaken in designated and signed areas to prevent leaks or spread of wastewater. • The concrete washout area will be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations. • The concrete washout area will have an impermeable surface with dedicated drainage systems that lead to separate sumps or treatment facility. • The removal of any sludge residues as solid hazardous waste will be undertaken by a licensed waste contractor and handled as a hazardous waste. • Concrete batching plants will not be installed on the PV plant site.
Medical Waste	• Any generated medical waste (i.e. form on-site clinics) will be stored in appropriate medical waste containers. • All medical waste will only be handled by trained personnel. • Removal of any medical waste from the site for appropriate treatment, disposal/incineration will only be conducted by a licensed contractor.

7.5.4 Operation Phase

Table 7-6 Waste & Wastewater Mitigation and Management Measures- Operations

Source	Mitigation and Management Measures
Inappropriate handling, storage, transport and disposal of non-hazardous solid waste	• Contractor to develop and implement a Project specific Operational Waste Management Plan (OWMP) in line with committed mitigation measures in this ESIA report and the provisions of the OESMP. • Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling. • Waste containers/skips will be clearly labeled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required for the workforce such as Uzbek and Russian. • For litter (food waste, domestic waste), an adequate number of covered bins will be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area. • Food waste must be stored within a sealed metal or plastic skip or bin, in order to prevent pests gaining access. • Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all lightweight material that could be blown away. • Paper cardboard, metal cans, plastic, glass to be collected for recycling by a licensed waste contractor. • Only licensed waste transporters and waste management facilities will be engaged.

SOURCE	MITIGATION AND MANAGEMENT MEASURES
	• The Contractor will maintain copies of the waste management licensed on site. • Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments. • Completed waste manifests are required to show the chain of custody of the waste generated on site, its transportation and treatment/disposal. All records will be maintained on site. • Engineered landfills will be used for all hazardous waste generated during construction and used for the disposal of non-recyclable general waste on a priority basis.
Inappropriate/uncontrolled handling, storage, transport and/or disposal of sanitary wastewater	• Sanitary facilities will be provided with adequately designed underground storage tanks. • Sanitary wastewater tanks to be properly maintained and inspected to ensure tanks do not overflow. • Sanitary wastewater tanks in allocated impervious hard standing areas with bunding capacity of 110% volume of the maximum volume stored. • Sanitary wastewater treated at the onsite sewage treatment plant must meet established limit for landscaping.
Inappropriate/uncontrolled handling, storage, transport and/or disposal of solid hazardous waste	• Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments. • Segregate and identify hazardous waste from the other waste streams into separate waste containers/skips clearly signed and labelled. • Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition. • The O&M Company will establish an on-site storage facility (i.e., designated holding area) where electronic O&M refuse, including spent or damaged PV modules/ panels and spent batteries, will be kept prior to scheduled transportation to specialized recycling facilities in or out of Uzbekistan (in accordance with the Hazardous Waste Management Plan). • Waste containers will be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required by the workforce such Uzbek & Russian. Wherever possible, chemicals will be kept in their original container. • Used face masks will be stored in designated bins and disposed of as medical waste. • A Hazardous Materials and Waste Management Plan will be developed and implemented for the Project's construction phase. The Plan will include arrangements and provisions (i.e., storage area/capacity, frequency of collection, distance of nearest disposal facilities) for various streams of waste, in consideration of the location of their respective management/ disposal facilities.

7.6 Monitoring Requirements

Table 7-7 provides an overview of the key monitoring arrangements for evaluating performance against applicable standards relating to waste management and resource efficiency, in the Project's construction and operational phases. A more elaborate coverage of these requirements will be provided in the Construction- and Operations-phase Environmental and Social Management Plans (C-ESMP, O-ESMP) and Environmental and Social Monitoring Plans (ESMoPs).

Table 7-7 Monitoring arrangements for impacts and preventative and mitigation measures relating to the management of waste (including wastewater)

E&S Impact	Key Performance Indicator/ Parameter	Target	Monitoring Location / Means of Verification	Monitoring Frequency	Responsible Entity
Contamination of resident soil, groundwater, and surface water	All waste to be collected by contractors with valid licenses/permits	- No collection of waste by contractors without valid licenses/ permits	- Permit register - Waste transfer log	Prior to waste transfer/ export	- EPC Contractor Environmental Officer
	Inspection and monitoring of handling and storage of waste materials	- Inspection and monitoring of waste management according to CESMP/OESMP procedures	- Inspection log	Weekly	- EPC Contractor Environmental Officer
	Records for waste transfers	- Consistent record keeping of waste transfer notes	- Waste transfer log	Monthly	- EPC Contractor Environmental Officer

8 NOISE AND VIBRATION

8.1 Legal Requirements and Standards

8.1.1 National laws and regulations

The SanPin no. 0267-09 (sanitary standard) for acceptable noise levels for habitable areas prescribes ambient noise limits within residential and public buildings, in relation to public health and safety.

Table 8-1 National thresholds for ambient noise within residential and public areas

LOCATION	TIME	SANPIN NO. 0267-09
Noise levels in public and residential areas	7am to 11pm	55dB(A)
	11pm to 7am	45dB(A)

Furthermore, the SanPinNo. no 03225-16 (sanitary standard) for permissible noise levels in the workplace prescribes ambient noise limits within industrial and commercial workplaces, in relation to occupational health and safety. The regulatory threshold for noise exposure in these environments is presented in the following table.

Table 8-2 National thresholds for ambient noise within commercial and industrial workplaces

TYPE OF WORK, WORKPLACE	REQUIREMENT
All activities and operations within industrial and commercial workplaces	80db(A)

8.1.2 Lender requirements

8.1.2.1 ADB

With regard to potential noise emissions from development projects, ADB's SPS stipulate that during the design, construction, and operation of the project, the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health, and Safety Guidelines. National requirements will override in the event that regulatory standards are more stringent.

8.1.2.2 IFC and EPFIs

The Equator Principles and relevant IFC HSSE guidelines potentially require adherence to WHO noise standards as detailed in World Bank EHS Guidelines (2007), which stipulate a maximum threshold of 70dB(A) at industrial or commercial receptors during daytime.

Table 8-3 World Bank Ambient Noise Level Guidelines

Receptor	One Hour LAeq (dBA)	
	Daytime (7am-10pm)	Night (10pm-7am)
Residential, institutional, and educational	55	45
Industrial, and commercial	70	70
Guideline values are for noise levels measured out of doors.		

Source: World Bank Group EHS General Guidelines, 2007.

These thresholds relate to receptors and not the plant boundary. Noise impacts should not exceed the levels presented above, or result in a maximum increase in background levels of 3 (dBA) at the nearest sensitive receptor location off-site.

Furthermore, the following requirements have also been specified in the WBG EHS noise guidelines:

- No employee should be exposed to a noise level greater than 85dB (A) for duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85dB (A), the peak sound level reaches 140dB(C), or the average maximum sound level reaches 110dB (A). Hearing protective devices provided should be capable of reducing sound level at the ear to at least 85dB (A).
- For every 3dB(A) increase in sound levels, the allowed exposure period or duration should be reduced by 50%.
- Where feasible, use of acoustic insulating materials isolations of the noise source and other engineering controls should be investigated and implemented prior to the issuance of hearing protection devices as the final control mechanism.

Medical hearing checks on workers exposed to high noise levels should be performed periodically.

8.2 Baseline Conditions

8.2.1 100 MW PV power plant

The 100 MW PV power plant site lies in a rural location situated 18 kilometres south-west of Samarkand city. Land-use within the site and surrounding landscape includes smallholder cultivation, livestock farming, residential establishments, and military base operations.

Observations made during field reconnaissance indicate that ambient noise levels are generally low in and around the project site. Discernible levels of ground borne vibration were not recorded during the site walkovers. Sources of noise identified over the course of the noise survey, include the following:

- The A-378 highway adjacent to the site, as well community tracks branching out of the highway.
- Crop farms and livestock sheds within and nearby the site.
- Military base located about 1.2 kilometres south of the site.

Noise-sensitive receptors broadly identified in the vicinity of the 100 MW PV power plant site include the residential establishments within the communities of Chortut and Sazagan.

8.2.1.1 Ambient noise monitoring

Following the identification of nearby receptors, a noise monitoring survey was carried out to establish the baseline level of ambient noise, as a frame of reference for modelling construction-phase noise influences and compliance monitoring during construction. The noise survey was carried out between 15 and 16 September 2023, at a representative receptor location in the vicinity of the 100 MW PV power plant site.

Table 8-4 Description of noise monitoring location nearby the 100 MW PV plant site

NOISE MONITORING LOCATION	DESCRIPTION	GPS COORDINATES	
		LATITUDE	LONGITUDE
NL 02	Residential establishment 140 metres north-west of the site	39.54918226	66.67143554

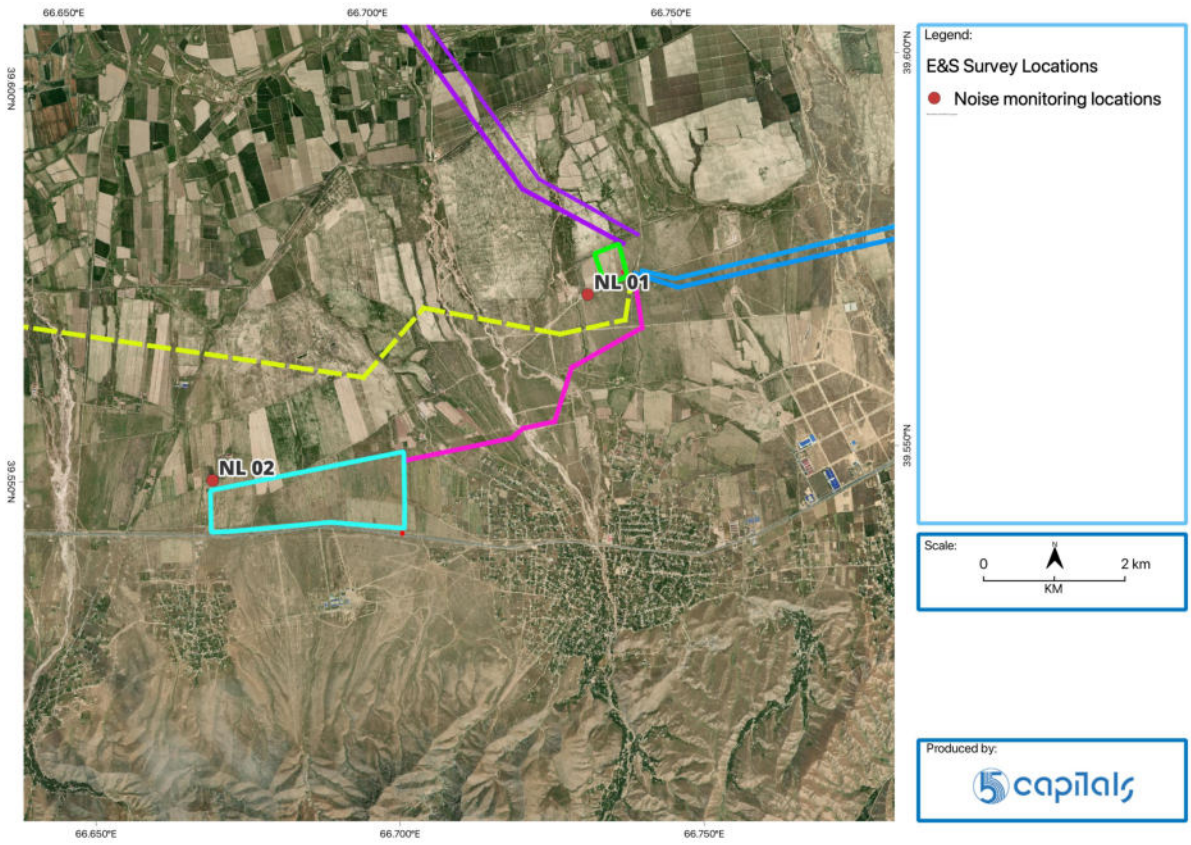


Figure 8-1 Noise monitoring location nearby the 100 MW PV power plant site

Ambient noise monitoring was undertaken using a Class 1 noise level meter (with a 100mm wind screen). The noise meters were mounted on tripods such that the microphone was fixed 1.2 metres to 1.6 metres above ground level, and no less than 3 metres from reflecting surfaces in efforts to attain free-field results.

The survey captured both working and weekend days, with daytime measurements between 7 am and 11 pm and night-time measurements between 11 pm and 7 am. A-weighted noise level measurements were made over continuous 24-hour durations and noise level data was logged at ten-minute intervals. Acoustic indices measured included L_{eq}(A), L_{max} (A), L_{90} (A) (A-weighted values expressed in decibels). Over the course of measurements, perceptible noise influences were recorded in terms of their sources, frequency, and perceived impact.

8.2.1.2 Monitoring results

The results of ambient noise measurements nearby the 100 MW PV plant site are presented in Table 8-5 below.

Table 8-5 Averaged results for noise monitoring near the 100 MW PV plant site

NOISE MEASUREMENT LOCATION	DATE	NOISE MEASUREMENT DURATIONS	LA_{EQ}	LA_{MAX}	LA_{MIN}	LA_{10}	LA_{90}	SANPIN STANDARDS (LA_{EQ})		IFC (EHS) GUIDELINE STADARDS (LA_{EQ})	
								RESIDENTIAL ZONES	COMMERCIAL AND INDUSTRIAL ZONES	RESIDENTIAL ZONES	COMMERCIAL AND INDUSTRIAL ZONES
NL 02	15-16 September, 2023	Daytime	41	56	35	43	38	55	80	55	70
		Night-time	45	55	36	48	40	45	80	45	70

As shown in Table 8-5, the analysis of noise level data included the establishment of averaged, A-weighted noise values for daytime and night-time monitoring durations.

Results for LA_{90}, which is the best indicator for ambient noise (environmental) noise, indicate that noise levels at the site exceed 38 dB(A), 90% of the time, during the day. The equivalent continuous sound pressure level (LA_{eq}) at the monitoring location is 41 dB(A) in the daytime. Daytime levels of ambient noise (in terms of LA_{eq}) were within regulatory and international limits for residential and commercial, and industrial zones.

The temporal variation in noise levels for the entire monitoring duration at this location was analysed using the graph (time-series) below.

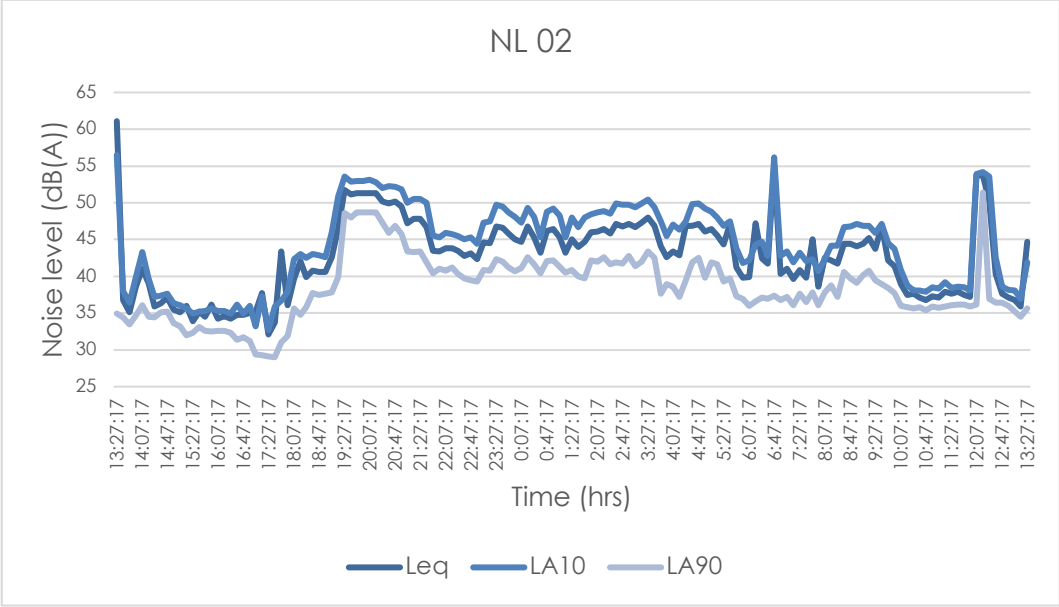


Figure 8-2 Variation in noise levels across the monitoring duration nearby the 100 MW PV plant site

As shown in Figure 8-2 Variation in noise levels across the monitoring duration nearby the 100 MW PV plant site above, predominant levels of ambient noise, which are best represented by the LA_{90} logs, tend to peak during the late evening hours between 7 pm and 9 pm. Elevated noise levels during this duration are attributable to influences from motorway traffic along the A-378 highway.

Discernible ground borne vibrations were not recorded over the course of the noise monitoring survey.

8.2.2 Nurobod BESS

The Nurobod BESS site is situated in a rural location 13 kilometres south-west of Samarkand City. Land-use within the site and surrounding landscape includes crop farming, grazing, and poultry farming.

Observations made during field reconnaissance indicate that ambient noise levels are generally low in and around the site and discernible levels of ground borne vibration were not recorded during the site walkovers. Sources of noise identified over the course of the noise survey, include the following:

- Livestock herds on resident and surrounding grazing areas.
- Crop farm and storage facility located 500 metres west of the site.
- Intermittent transit along community tracks in and around the site.
- Quarrying operations at gravel and sand mining facilities located 780 metres west of the site.
- A few residential facilities within Saroy community (makhalla).

Noise-sensitive receptors broadly identified in the vicinity of the site include a few residential and farming establishments within the communities of Dostlik MFY and Saroy.

8.2.2.1 Ambient noise monitoring

Following the identification of noise-sensitive receptors, a noise monitoring survey was carried out to establish the baseline level of ambient noise, as a frame of reference for modelling construction-phase noise influences and compliance monitoring during construction. The noise survey was carried out between 14 and 15 September 2023, at a representative receptor location in the vicinity of the Nurobod BESS site.

Table 8-6 Description of noise monitoring location nearby the Nurobod BESS site

NOISE MONITORING LOCATION	DESCRIPTION	GPS COORDINATES	
		LATITUDE	LONGITUDE
NL 01	Farm warehouse and shelter located 290 metres West of the BESS site	39.57085446	66.73446077

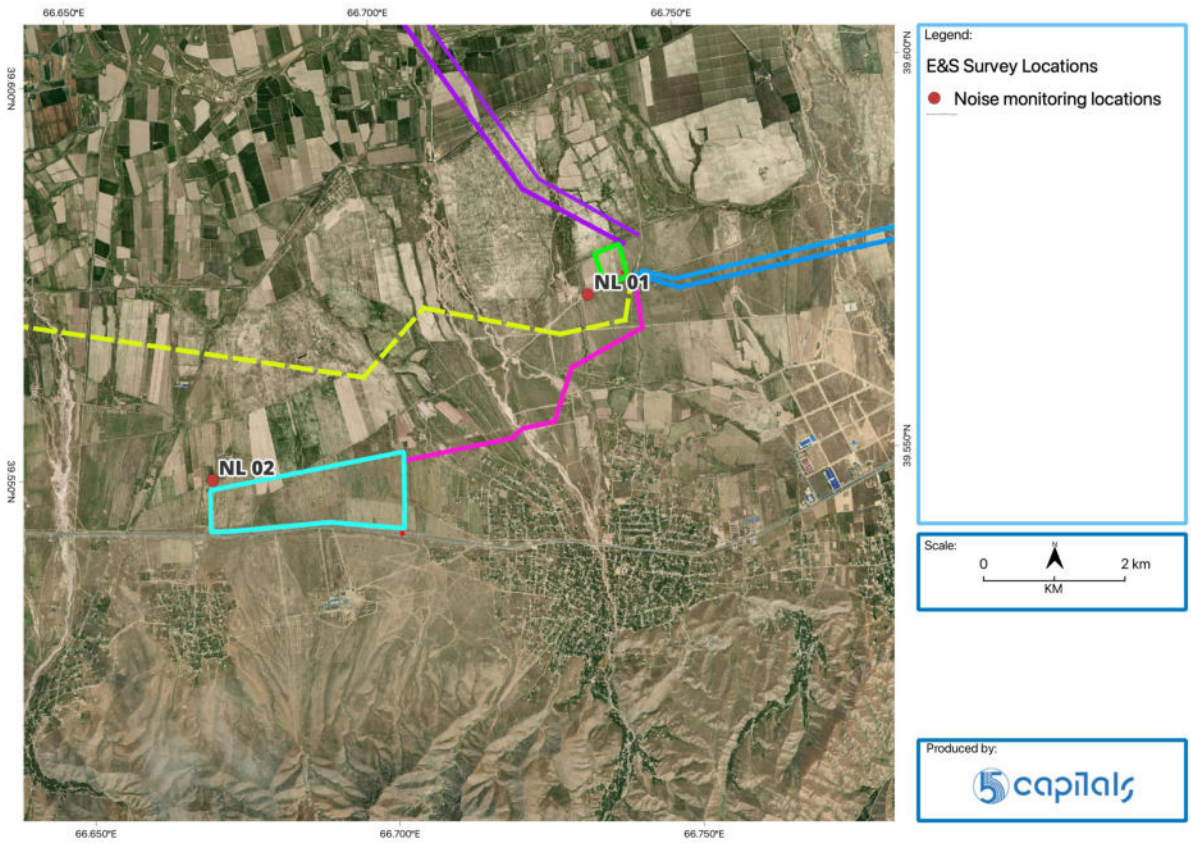


Figure 8-3 Noise monitoring location nearby the Nurobod BESS site

Ambient noise monitoring was carried out using the methodology described in Section 8.2.1.1.

8.2.2.2 Monitoring results

The results of ambient noise measurements nearby the Nurobod BESS site are presented in Table 8-7 below.

Table 8-7 Averaged results for noise monitoring near the Nurobod BESS site

NOISE MEASUREMENT LOCATION	DATE	NOISE MEASUREMENT DURATIONS	LA_{EQ}	LA_{MAX}	LA_{MIN}	LA_{10}	LA_{90}	SANPIN STANDARDS (LA_{EQ})		IFC (EHS) GUIDELINE STADARDS (LA_{EQ})	
								RESIDENTIAL ZONES	COMMERCIAL AND INDUSTRIAL ZONES	RESIDENTIAL ZONES	COMMERCIAL AND INDUSTRIAL ZONES
NL 01	14-15 September, 2023	Daytime	45	63	34	45	37	55	80	55	70
		Night-time	47	61	40	49	44	45	80	45	70

As shown in Table 8-7 the analysis of noise level data included the establishment of averaged, A-weighted noise values for daytime and night-time monitoring durations.

Results for LA_{90}, which is the best indicator for ambient noise (environmental) noise, indicate that noise levels at the site exceed 37 dB(A), 90% of the time, during the day. The equivalent continuous sound pressure level (LA_{eq}) at the monitoring location is 45 dB(A) in the daytime. Daytime levels of ambient noise (in terms of LA_{eq}) were within regulatory and international limits for residential and commercial, and industrial zones, however, both thresholds for night-time ambient noise in residential zones were exceeded.

The temporal variation in noise levels for the entire monitoring duration at this location was analysed using the graph (time-series) below.

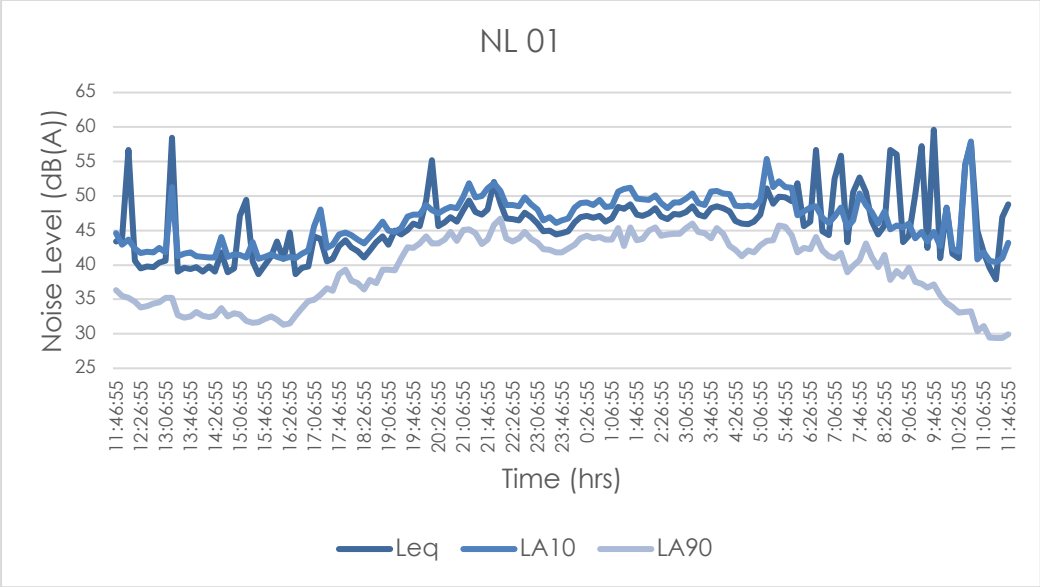


Figure 8-4 Variation in noise levels across the monitoring duration nearby the Nurobod BESS site

As shown in Figure 8-4 Variation in noise levels across the monitoring duration nearby the Nurobod BESS site above, predominant levels of ambient noise, which are best represented by the LA_{90} logs, tend to peak during the late evening hours between 9 pm and 10 pm. Elevated noise levels during this duration are attributable to influences from the nearby livestock farms and vehicular traffic along the track located south of the site.

Discernible ground borne vibrations were not recorded over the course of the noise monitoring survey.

8.2.3 400 MW PV power plant and pooling station

The 400 MW PV power plant and pooling stations sites lie in a rural location situated 80 kilometres south-west of Samarkand city and 82 kilometres north-west of Shahrisabz City. Land-use within the sites and surrounding landscape includes crop farming, grazing and residential establishments.

Observations made during field reconnaissance indicate that ambient noise levels are generally low in and around these sites and discernible levels of ground borne vibration were not recorded during the site walkovers. Sources of noise identified over the course of ESIA reconnaissance and follow-up baseline surveys, include the following:

- Livestock herds on resident and surrounding grazing land.
- Intermittent transit along community tracks in and around the site.
- Residential facilities within Charvador and Olga makhallas (communities).

Noise-sensitive receptors broadly identified in the vicinity of the 400 MW PV power plant and pooling station sites include the residential establishments within the communities of Charvador and Olga.

8.2.3.1 Ambient noise monitoring

Following the identification of noise-sensitive receptors, a noise monitoring survey was carried out to establish the baseline level of ambient noise, as a frame of reference for modelling construction-phase noise influences and compliance monitoring during construction. The noise survey was carried out between 16 and 17 September 2023, at two representative receptor locations in the vicinity of the 400 MW PV power plant and pooling station sites.

Table 8-8 Description of noise monitoring location nearby the 400 MW PV plant and pooling station sites

NOISE MONITORING LOCATION	DESCRIPTION	GPS COORDINATES	
		LATITUDE	LONGITUDE
NL03	Nearest residential establishment located 114 metres East of the PV power plant site	39.44496416	65.99368243
NL04	Nearest residential establishment located 670 metres South of the pooling station site	39.42182386	65.96611658

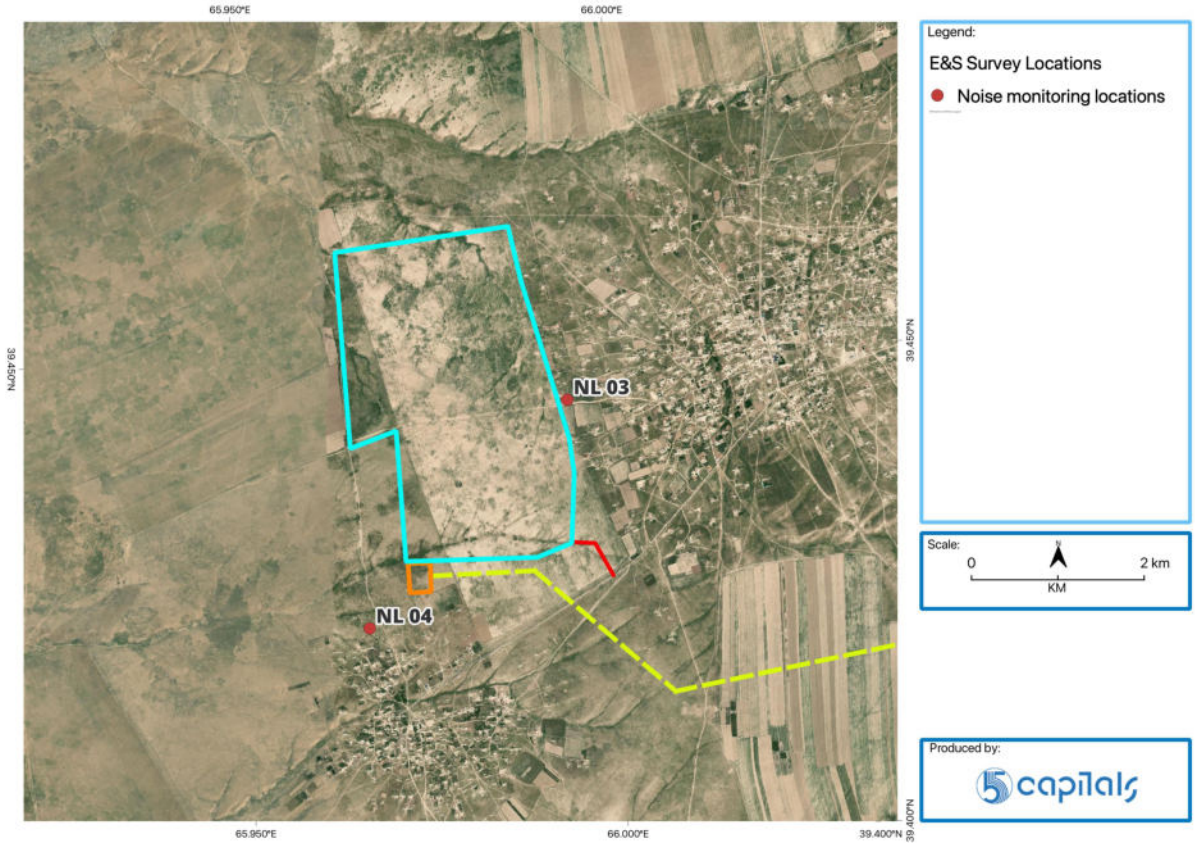


Figure 8-5 Noise monitoring locations nearby the 400 MW plant and pooling station sites

Ambient noise monitoring was carried out using the methodology described in Section 8.2.1.1.

8.2.3.2 Monitoring results

The results of ambient noise measurements nearby the 400 MW PV plant and pooling station sites are presented in Table 8-9 below.

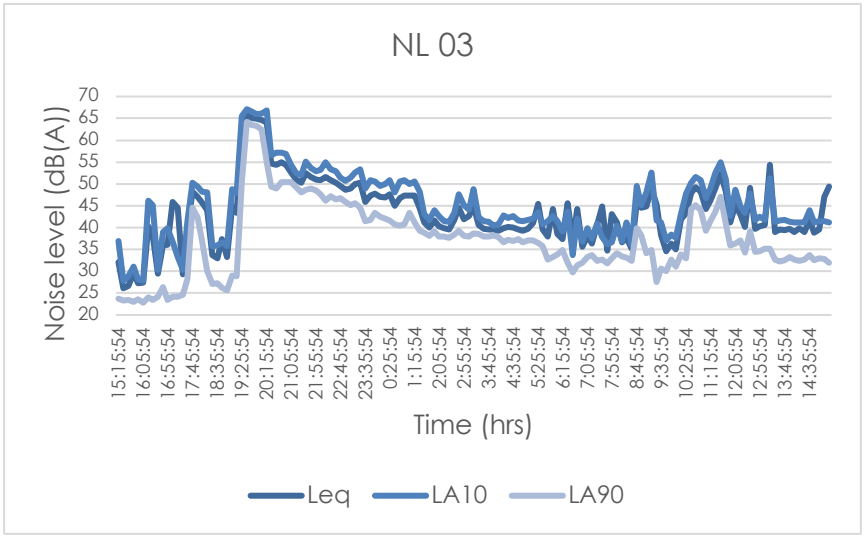
Table 8-9 Averaged results for noise monitoring near the 400 MW PV plant and pooling station sites

NOISE MEASUREMENT LOCATION	DATE	NOISE MEASUREMENT DURATIONS	LA_{EQ}	LA_{MAX}	LA_{MIN}	LA_{10}	LA_{90}	SANPIN STANDARDS (LA_{EQ})		IFC (EHS) GUIDELINE STADARDS (LA_{EQ})	
								RESIDENTIAL ZONES	COMMERCIAL AND INDUSTRIAL ZONES	RESIDENTIAL ZONES	COMMERCIAL AND INDUSTRIAL ZONES
NL 03	16-17 September, 2023	Daytime	44	58	33	45	37	55	80	55	70
		Night-time	43	54	36	45	38	45	80	45	70
NL 04	16-17 September, 2023	Daytime	40	56	28	41	31				
		Night-time	43	54	35	45	38				

As shown in the table above, the analysis of noise level data included the establishment of averaged, A-weighted noise values for daytime and night-time monitoring durations.

Results for LA_{90}, which is the best indicator for ambient noise (environmental) noise, indicate that noise levels at the site exceed 31dB(A) and 37 dB(A) respectively, 90% of the time, during the day. The equivalent continuous sound pressure level (LA_{eq}) at the monitoring location ranges from 40 dB(A) to 45 dB(A) in the daytime. Daytime and night-time levels of ambient noise (in terms of LA_{eq}) did not exceed regulatory and international thresholds for residential and commercial, and industrial zones.

The temporal variation in noise levels for the entire monitoring duration at this location was analysed using the graph (time-series) below.



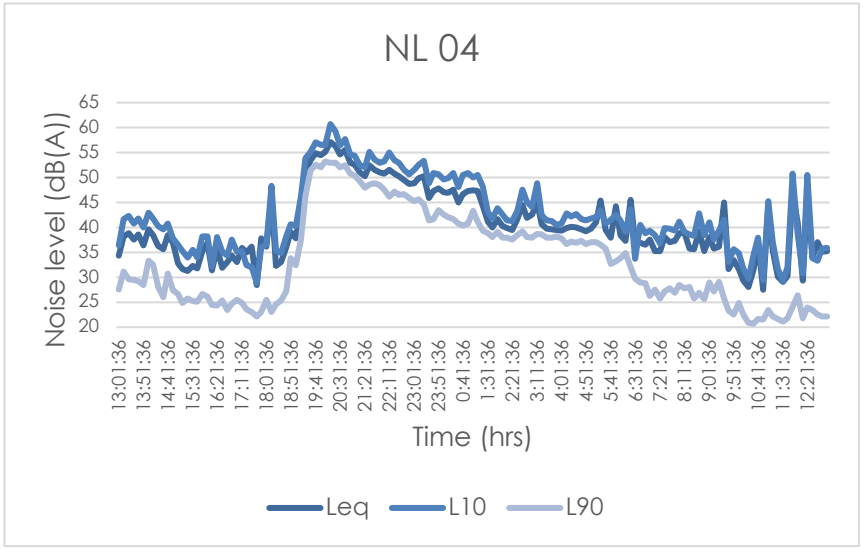


Figure 8-6 Variation in noise levels across the monitoring duration nearby the 400 MW PV plant and pooling station sites

As shown in Figure 8-6 Variation in noise levels across the monitoring duration nearby the 400 MW PV plant and pooling station sites above, predominant levels of ambient noise, which are best represented by the LA_{90} logs, tend to peak during the late evening hours around 8 pm. Elevated noise levels during this duration are attributable to influences from the nearby residential communities.

Discernible ground borne vibrations were not recorded over the course of the noise monitoring survey.

8.2.4 4.9 km OTL

The 4.9-km OTL corridor traverses a steppe landscape including grazing areas and small-scale crop farms. Observations made during field reconnaissance indicate that ambient noise levels are generally low in and around the corridor, with the exception of sections located nearby the A378 highway and community tracks. Discernible levels of ground borne vibration were not recorded during the site walkovers.

Noise-sensitive receptors broadly identified in the vicinity of the OTL include the residential establishments and crop farms located within the communities (makhallas) of Sazagan and Saroy.

8.2.5 70 km OTL

The 70-km OTL corridor traverses an expanse of rural land with predominantly agricultural land-use. Observations made during field reconnaissance indicate that ambient noise levels are generally low in and around the corridor, with the exception of sections intersecting and/or adjoining the A378 highway, national railway and community tracks. Discernible levels of ground borne vibration were not recorded during the site walkovers, although the middle section of the OTL lies 1.3 kilometres south of a uranium mining zone where intensive drilling is planned.

Noise-sensitive receptors broadly identified in the vicinity of the OTL include the residential establishments and crop farms located within the 12 affected communities (makhallas).

8.2.6 11-km and 19-km (LILO) OTLs

The 11-km and 19-km OTLcorridors traverse a heavily cultivated landscape including grazing crop farms, animal farms, as well as residential clusters. Observations made during field reconnaissance indicate that ambient noise levels are generally low in and around the corridor, with the exception of segments crossing the densely populated residential clusters in Pastdargom and Samarkand Districts. Discernible levels of ground borne vibration were not

recorded during the site walkovers but may occur close to the railway line intersecting the 19-km OTL corridor.

Noise-sensitive receptors broadly identified in the vicinity of the OTL include the residential buildings, farming establishments and nearby roads.

8.3 Receptors

The following table provides an overview of E&S impact receptors in the context of potential noise and vibration impacts within the Project's Areas of Influence (AoI). A sensitivity rating and corresponding description is provided for each relevant receptor.

Table 8-10 E&S impact receptors – Noise and vibration

RECEPTOR	SENSITIVITY	JUSTIFICATION
Construction workers	High	Construction workers have a potentially high sensitivity to noise emissions and vibration from sources at close range.
O&M workers	High	O&M workers have a potentially high sensitivity to noise emissions and vibration from sources at close range.
Residential and institutional establishments	High	Residents within nearby residential and institutional (i.e., schools, clinics, mosques) establishments have a potentially high sensitivity to noise emissions and ground-borne vibration from project activities. Baseline levels of ambient noise are generally low.
Commercial and industrial establishments	Medium	Residents within nearby commercial and industrial establishments have a relatively low sensitivity to noise emissions and ground-borne vibration from project activities (in comparison with residential receptors).
Ecological receptors (i.e., fauna)	Medium	Mammal, herptile and avian species resident in and around the Nurobod BESS, 400 MW PV plant sites, and certain OTL corridor sections have a potentially moderate sensitivity to acoustic disturbances and ground borne vibration, which can trigger transient displacement and dispersal and thereby affect breeding and foraging patterns.

8.4 Potential Impacts

8.4.1 Construction phase

8.4.1.1 Elevated levels of ambient noise

The Project's construction phase will involve a broad range of noise-generating activities, including the pile driving, offloading of materials and equipment, movement of construction vehicles, and the operation of other construction machinery (e.g., excavators, compactors etc.). Stationary and mobile sources of construction noise have the potential to influence

ambient noise levels within the vicinity of the project sites and transit corridors. The establishment of temporary on-site facilities for construction labour, such as staff offices and canteens, may also contribute to an intermittent increase in ambient noise, beyond the project site.

Noise emissions from construction activities potentially pose a nuisance to noise-sensitive human receptors located within close proximity to the project sites (i.e., typically within 300 metres of construction noise sources). For nearby residential, institutional and commercial establishments, elevated levels of ambient noise arising from construction works may cause annoyance, impaired concentration, and sleep disturbance. Noise-sensitive establishments located nearby the 400 MW PV plant, pooling station, and the access roads leading up to the different project sites will have a relatively high exposure to construction-related noise.

For ecological receptors within adjacent habitats, construction-related noise and instances of impulsive noise can lead to a transient displacement of resident species (i.e., dispersal and habitat avoidance), which can disrupt the normal ecological processes within these habitats, such as breeding and foraging.

In the absence of mitigation, the impact significance is potentially moderate, considering the presence of sensitive land-uses nearby the project sites and the 400 MW PV plant site in particular, where noise-sensitive dwellings with a low ambient noise baseline are located in close range.

The major to moderate severity of this potential impact can be reduced to a minor status, with the application of impact monitoring mitigation measures, including the use of noise barriers, noise abatement equipment, and minimal, on-demand operation of noise-generating machinery.

QUANTITATIVE MODELLING OF NOISE EMISSIONS FROM CONSTRUCTION EQUIPMENT

To gauge the level of acoustic disturbance to off-site receptors from construction-related noise, a basic noise prediction model has been adopted in line with specific guidance provided in the *BS 5228-1:2009 - British Standards: Code of practice for noise and vibration on construction and open sites*. The modelling commenced with the identification of typical noise emission levels for the range of equipment to be employed in construction works. The noise levels, expressed in terms of A-weighted continuous sound pressure level (i.e., LAeq) at 10 metres at 10 metres' distance from the equipment location, were drawn from the Standards.

Table 8-11 Provisional list of construction equipment and respective noise levels at 10 metres' range

CONSTRUCTION EQUIPMENT	BS 5228-1:2009 REFERENCE CODE	SOUND PRESSURE LEVEL, LA_{EQ} DB (A)
Bulldozer	Table C.5, No.14	81
Excavator	Table C.2, No.43	78
Mobile crane	Table C.4, No.52	75
Dump truck	Table C.2, No.31	87
Truck-mounted drill rig	Table C.3, No.15	82
Maximum total source noise contribution at 10 metres		86.4

The predictive calculations set out in *Annex F* of the Standards were premised on the following precautionary assumptions for a worst-case noise emissions scenario:

- Each piece of equipment will only be operational for 50% of the working day.
- The equipment is located at the same location at the boundary of the site.

Subsequently, a number of noise propagation parameters were included in the noise modelling equations, namely (i) distance attenuation, (ii) ground absorbance, and (iii) barrier attenuation. The adjustment due to ground absorbance has been made based on all nearby receptors being >25m from source and using the equation; 25*LOG(10/Distance to receptor)+2.

Table 8-12 Predicted increases in ambient noise levels at surveyed receptor locations

RECEPTOR	BASELINE NOISE LEVEL		ANTICIPATED CONSTRUCTION NOISE AT RECEPTOR (DBA)	CALCULATED NOISE LEVEL AT RECEPTOR LOCATION (DBA)		CHANGE FROM BASELINE	
	DAY	NIGHT		DAY	NIGHT	DAY	NIGHT
NL-01	45	47	51.9	52.7	53.1	7.7	6.1
NL-02	41	45	59.8	59.9	59.9	18.9	14.9
NL-03	44	43	62.0	62.1	62.1	18.1	19.1
NL-04	40	43	42.8	44.6	45.9	4.6	2.9

Paragraph E.3.2 of BS5228 describes the ABC Method, which considers the existing ambient noise environment (the LA_{eq} noise level environment) at the neighbouring sensitive receptors and identifies levels, which, if exceeded, would be considered to result in a significant adverse effect. This method is notably applicable to residential receptors exclusively.

Table E.1 of BS5228 sets out significance effect threshold values at receptors. The process for determining this requires the determination of the ambient noise level at the relevant receptor (rounded to the nearest 5 dB), which is then compared to the total noise level, including the predicted construction noise level. If the combined noise level exceeds the appropriate category value, then the impact is deemed to be significant. The relevant statistics from Table E.1 are set out in the following table.

Table 8-13 Construction Phase Noise – ABC Assessment

ASSESSMENT CATEGORY AND THRESHOLD VALUE PERIOD (L_{Aeq})	THRESHOLD VALUE, IN DECIBELS - DB(A)		
	CATEGORY A	CATEGORY B	CATEGORY C
Daytime (07:00 to 19:00 hrs) and Saturdays (07:00 to 13:00 hrs)	65	70	75
Evenings and weekends	55	60	65
Night-time (23:00 to 07:00 hrs)	45	50	55
Note 1: A significant effect has been deemed to occur if the total LA_{eq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.			
Note 2: If the ambient noise level exceeds the threshold values given in the table (i.e., the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total LAeq noise level for the period increases by more than 3 dB due to construction activity.			
Note 3: The above impact assessment method is applicable to residential receptors exclusively. A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

Note: The ABC Method does not provide levels of significance, as such professional judgement has been applied for relevant evaluation within applicable significance tables.

Based on this method, the cumulative (construction-influenced) noise levels predicted for each of the three residential receptors do not exceed the corresponding "Category A" thresholds for daytime noise. As such, the predicted noise level increases at these receptors represent a potentially low acoustic impact.

8.4.1.2 Elevated levels of ground borne vibration

The Project's construction phase will entail a number of site preparation and construction activities that will employ vibration-generating machinery and equipment. These activities typically include land clearing, grading, excavation, rock-breaking, compaction and pile driving. Different levels of ground borne vibration emanate from heavy construction

machinery, such as bulldozers, excavators, graders, vibratory rollers, drill rigs, cranes, and Heavy Goods Vehicles (HGVs).

The propagation of ground borne vibration from sources within construction areas is dependent on a number of factors, including at-source ground vibration frequency, ground conditions and topography. The intensity of ground borne vibration typically decreases with increasing distance away from the source, as energy is dissipated through propagation media. The main impacts associated with the generation of major ground borne vibration beyond construction zones can be categorized as follows:

- Disturbance to occupants of nearby residential, institutional, commercial, and industrial establishments (i.e., distress, interrupted concentration, and sleep disruptions).
- Temporary effects on nearby built-up structures and building contents (i.e., shaking structures, associated rattling).
- Structural damage to nearby buildings, particularly foundation failures and wall cracks or fissures.
- Displacement of burrowing fauna resident with adjacent habitats.

The standard measure for construction-related vibration is Peak Particle Velocity (PPV). The table below indicates a scale for the perceptibility of vibration levels from construction machinery.

Table 8-14 Vibration levels and corresponding degree of perception

VIBRATION LEVEL (PPV)	DEGREE OF PERCEPTION
0.1	Not perceptible
0.15	Threshold of perception
0.35	Slightly noticeable
0.7-1	Noticeable
2.2	Highly noticeable
5 – 6	Disturbing to human receptors Cosmetic damage to buildings is possible, with continuous work
10	Disturbing to human receptors Minor damage to buildings is possible, with continuous work
20	Disturbing to human receptors Major damage to buildings is possible, with continuous work

In general, reported distances from ground borne vibration sources within which regular inspection of building condition is recommendable for timely identification of related structural damages are (i) 50 metres for compaction and demolition activities, and (ii) 100 meters for pile driving. Residential and commercial establishments located within the immediate vicinity of

the project sites and those based around the access tracks leading up to the project sites are therefore subject to vibration-related nuisances and the remote risk of property (structural) damage from any extreme and/or continuous vibration-generation events during construction works. The impact is likely to be highest for the housing and temporary structures located within 100 metres of the 100 MW PV plant, 400 MW PV plant and Nurobod BESS sites.

With regard to sensitive ecological receptors within habitats located in the 400 MW PV plant and Nurobod BESS sites, potentially high levels of ground borne vibration from the operation of heavy construction machinery present an additional form of acoustic disturbance to burrowing fauna. As with high levels of ambient noise, these disturbances can induce the transient displacement of resident faunal species from suitable habitats.

8.4.1.3 Occupational exposure to noise and vibration

Construction workers are particularly prone to adverse impacts associated with construction noise and vibration. Frequent exposure to high levels of continuous and intermittent noise, and repeat exposure to impulse noise, pose a range of occupational health conditions, such as irritability, fatigue, auditory impairment, and hearing loss.

Similarly, prolonged exposure to vibratory equipment and hand-held power tools can result in a number of short-lived and chronic health complications. Over time, Hand-Arm Vibration (HAV) can cause a sustained loss of sensation in hands and fingers, musco-skeletal disorders and HAV syndrome. Whole-body vibration can also lead to health effects such as fatigue, motion sickness and muscular conditions.

Table 8-15 Overview of potential impacts relating to noise and vibration during construction

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-management Impact Significance	Residual Impact Significance
PV Plant and BESS Sites						
Elevated levels of ambient noise	Project sites and the surrounding vicinity (audible influence potentially extending between 500 m and 1 km from on-site sources and transit corridor/ access routes)	Moderate	Residential and institutional establishments	High	**Moderate/ Major**	**Minor/ Moderate**
			Commercial and industrial establishments	Medium	**Moderate**	**Minor**
			Ecological receptors	Medium	**Moderate**	**Minor**
Elevated levels of ambient ground borne vibration	Project sites, transit corridors, and the surrounding vicinity (audible influence potentially extending between 500 m and 1 km from on-site sources and transit corridor/ access routes)	Moderate	Residential and institutional establishments	High	**Moderate/ Major**	**Minor/ Moderate**
			Commercial and industrial establishments	Medium	**Moderate**	**Minor**
			Ecological receptors	High	**Moderate/ Major**	**Minor/ Moderate**
Occupational exposure to noise and vibration	Construction zones and adjacent labour facilities within the project sites	Moderate	Construction workers	High	**Moderate/ Major**	**Minor/ Moderate**
OTL Sites						
Elevated levels of ambient noise	Project sites and the surrounding vicinity (audible influence potentially extending between 500 metres and 1 kilometre from on-site sources and transit corridor/ access routes)	Minor	Residential establishments	High	**Moderate/ Major**	**Minor/ Moderate**
			Commercial and industrial establishments	Medium	**Moderate**	**Minor**
			Ecological receptors	Medium	**Moderate**	**Minor/ Moderate**

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-management Impact Significance	Residual Impact Significance
Impact Avoidance and Mitigation Measures						
Elevated levels of ambient noise • Noise-generating activities will be sequenced or phased where possible (rather than simultaneous execution) as to keep any disturbance from noise to a minimum. • Consideration of acoustic enclosures and barriers (e.g., equipment housing and shielding, perimeter fencing), or other methods to attenuate construction noise, will be required close to non-mobile sources of noise. • Acoustic covers on machine engines to remain closed at all times as applicable. • Where practical, electrically powered plant will be preferred to mechanically powered alternatives. • All mechanically powered plant, diesel engine vehicles and compression equipment will be fitted with noise control components (exhaust silencers, mufflers) as available from the manufacturer. • Equipment and operations with high acoustic impacts will be sited as far as possible from sensitive receptors located within and nearby the project sites • Careful handling of materials and waste such as lowering rather than dropping items. • Night-time construction works will be avoided to the extent feasible. Where unavoidable, night work permits (if applicable) will be obtained from the relevant authorities. • Wherever practical, all equipment generating ground vibration (e.g., ground compactors, jack hammers, pile drivers and heavy goods vehicles) and activities will be sited away from the Project boundary. • Equipment and machinery generating noise and/or ground-borne vibration will be switched off when not in use. • Delivery vehicles will be prohibited from waiting outside the site with their engines running (consideration of driver waiting room with heating/AC). • Ensure any applicable permits are in place for deliveries to the site and for any works performed outside normal working hours. The movement of heavy vehicles during the night will be avoided to the extent feasible. • Review vendor specifications and accept site plant and vehicles, in particular heavy vehicles, based on noise generation (as far as practical). • Where available in country, audible reversing alarms with broadband noise (white noise) will be preferred over tone alarms (beeping), to limit external disturbance to communities. • Speed limits established in the Traffic Management Plan will be adhered to. • Notice will be provided to the sensitive receptors along as early as possible (minimum one-week notice) of periods of nosier works in regard to certain construction activities and for how long such activities will be likely to last in accordance with the Stakeholder Engagement Plan (SEP).						

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-Management Impact Significance	Residual Impact Significance

- Resident communities and establishments based around the project sites will be familiarized with the Project's community GRM, to enable the collection of relevant grievances on platforms that are accessible to all local constituencies and free of manipulation, interference, intimidation, service charges and restrictions on arbitration, judicial recourse, and choice of confidentiality.
- Based on the ESIA and any follow-up risk assessment, the EPC Contractor will develop and implement a (i) Noise Management Plan and (ii) Traffic Management Plan and incorporate these plans into all relevant method statements.

Elevated levels of ground borne vibration

- Equipment and machinery generating noise and/or ground-borne vibration will be switched off when not in use.
- Concurrent vibratory impact from multiple sources will be minimized to the extent feasible.
- Affected communities will be informed of the timeline of the works which may result in vibration impacts.
- Where practical, vibration-generating activities be strategically sited within central locations in construction sites.
- Vehicles and mechanical plant will be maintained in good condition to minimise excessive vibration.

Exposure to occupational noise and vibration

- Identify workers who may be exposed to elevated noise levels (equal to or exceeding 80dB(A)) and brief them on occupational risks from noise exposure. Provide noise reduction PPE to workers.
- Respond to noise related complaints from workers and take corrective and preventive actions as necessary.
- Use hierarchy of control related to noise to reduce impact on workers (in the order of physical removal of noise source, replace with quieter options, isolate workers from the high-noise source, change the work methodology, and use of PPE).
- Operators of vibrating hand-held machinery (if any) will be provided with appropriate PPE (e.g., protective gloves and ear muffs/plugs) and be given suitable breaks from using such equipment to reduce the impacts of vibration.
- Workers potentially exposed to high noise and vibration will be provided with appropriate PPE with respect to the occupational Health and Safety (H&S) risk assessments conducted for specific activities.
- Workers potentially exposed to high noise and vibration will be trained to identify situation when PPE is required to be worn and on how to effectively utilize the PPE.
- Monitoring of working locations with substantial noise emissions will be conducted as required to assess occupational noise related potential issues and hearing tests will be conducted on workers if required based on risk assessment which will be further detailed in the occupational H&S Plan.
- These mitigation measures will be incorporated to the applicable occupational H&S plan being developed and implemented on-site.

8.4.2 Operational phase

8.4.2.1 Elevated levels of ambient noise

At the operational stage, noise emissions will arise from the operation of numerous and high-voltage electrical equipment. For PV plant facilities, these emissions potentially comprise low-frequency, humming noise from constituent inverters and medium-to-high voltage transformers. For the BESS plant, operational noise emissions will likewise be generated by the array of inverters and transformers, as well as the high-capacity Heating, Ventilation and Air Conditioning (HVAC) system.

Corona discharge and associated crackling noise can also occur around overhead, high-voltage conductors in the PV plant site and OTLs. However, the intensity of corona noise is proportional to the level of discharged voltage/ current, and the probability of audible levels of corona noise from high-voltage conductors is notably low, given the considerable vertical and horizontal intervening distances between such conductors and potential receptors (taking into account humid conditions, which are most conducive to the corona effect).

The movement of vehicles for transportation of O&M workers and transfer of materials and equipment for maintenance purposes may influence ambient noise levels. Nevertheless, affected communities surrounding the PV plant sites and access roads connecting to the project sites are located very close to existing highways and municipal roads.

8.4.2.2 Occupational exposure to noise

The above-described noise emissions will occur for the duration of the Project's operational phase. For the PV plant site, the Project's O&M personnel are subject to occasional nuisances from low levels of operational noise from the network of inverters and collector sub-station, during outdoor O&M activities within the PV plant site. Any acoustic influences from the facility will not be felt within on-site staff buildings.

Similarly, O&M workers within the BESS site are subject to outdoor exposure to low-frequency noise emissions from the array of inverters, transformers, and the HVAC system. This impact will not occur on a frequent basis, as the O&M personnel will be stationed within the on-site offices.

Table 8-16 Overview of potential impacts relating to noise and vibration during operation

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-management Impact Significance	Residual Impact Significance
Elevated levels of ambient noise	Vicinity of the BESS site and access roads towards the PV plant and BESS sites	Minor	Residential and institutional establishments	High	**Minor/ Moderate**	**Minor**
Exposure to occupational noise	Workstations within the BESS site	Minor	O&M workers	High	**Minor/ Moderate**	**Minor**

Impact avoidance and mitigation measures

Elevated levels of ambient noise

- Noise generating equipment will be housed within enclosures to the extent feasible.
- A permanent fence will be established around the PV power plant and BESS, sites to provide an acoustic barrier, and vegetation screens will be maintained where possible.
- Regular inspection and maintenance of operational equipment and machinery, including vehicles.

Exposure to occupational noise

- Soundproofing measures will be implemented for on-site offices within the BESS site.
- O&M workers with frequent or extended exposure to operational noise within the BESS will be provided with hearing protection (PPE).

8.4.3 Decommissioning phase

Project decommissioning will entail the deconstruction of project facilities, demobilization of related equipment and materials, as well as potential repurposing and/or rehabilitation works. At this stage, potential impacts relating to noise and vibration will be similar to the above-described construction-phase impacts. Specifically, this set of impacts potentially includes:

- Elevated levels of ambient noise
- Elevated levels of ambient ground borne vibration
- Occupational exposure to noise and vibration

For the avoidance and mitigation of these impacts, relevant impact management measures specified in Section 8.4.1 will be implemented. Accordingly, the same pre-management and residual significance ratings are provisionally assigned to mutually relevant impacts on noise-sensitive receptors.

8.5 Monitoring Requirements

Table 8-17 below provides an overview of the key monitoring arrangements for evaluating performance against applicable standards relating to noise and vibration, in the Project's construction and operational phases. A more elaborate coverage of these requirements will be provided in the Construction- and Operations-phase Environmental and Social Management Plans (C-ESMP, O-ESMP) and Environmental and Social Monitoring Plans (ESMoPs).

Table 8-17 Monitoring arrangements for impacts and preventative and mitigation measures relating to noise and vibration

E&S Impact	Key Performance Indicator/ Parameter	target	Monitoring Location / Means of Verification	Monitoring Frequency	Responsible Entity
Occupational exposure to noise and vibration	Grievances concerning noise	- All related grievances are closed out within the shortest practicable duration	- Worker Grievance Log	On-going	- EPC Contractor HR/ H&S Officer
Elevated levels of ambient noise	A-weighted, equivalent continuous sound level – daytime noise (7am to 11pm)	- 55dB(A)	- Noise monitoring locations targeted for ESIA baseline survey	Monthly or after relevant grievance(s)	- EPC Contractor Environmental Officer
	A-weighted, equivalent continuous sound level night-time noise (11pm to 7am)	- 45dB(A)	- Noise monitoring locations targeted for ESIA baseline survey		
	Grievances concerning noise	- All related grievances are closed out within the shortest practicable duration	- Community Grievance Log	On-going	- EPC Contractor CLOs

9 AIR QUALITY

9.1 Legal Requirements and Standards

9.1.1 National laws and regulations

9.1.1.1 The Law of the Republic of Uzbekistan "On Atmospheric Air Protection" (1996, amended on 13.03.2019)

This regulation specifies air pollution and carbon emission standards within the national industry and transportation sectors, ozone layer protection requirements, and provides for compensation related to air pollution impacts.

9.1.1.2 SanPiN № 0293-11

The Standard prescribes Maximum Permissible Concentrations (MPC) for a number of common pollutants within residential, public and industrial environments.

Table 9-1 Ambient air quality MPC (mg/m³)

POLLUTANT	(MPC MG/M³)			
	ONE-TIME	24-HOUR	MONTHLY	ANNUAL
NO_2	0.085	0.06	0.05	0.04
NO	0.6	0.25	0.12	0.06
CO	5	4	3.5	3
SO_2	0.5	0.2	0.1	0.05
NH_3	0.2	0.12	0.06	0.04

Note: Maximum one-time concentration is defined as the highest concentration detected at 20–30-minute sampling.

- Average daily concentration is the average of the one-time concentrations detected during the day or obtained with continuous 24-hour sampling.
- Monthly average concentration is the average of the average daily concentration detected during the month.
- Average annual concentration - the average of the number of average monthly concentrations revealed during a year in the course of one-time sampling.

9.1.2 Lender requirements

9.1.2.1 ADB

With regard to potential air pollutant emissions from development projects, ADB's SPS stipulate that during the design, construction, and operation of the project, the borrower/client will apply pollution prevention and control technologies and practices consistent with

international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health, and Safety Guidelines. National requirements will override in the event that regulatory standards are more stringent.

9.1.2.2 IFC and EPFIs

WHO ambient air quality standards as adopted by the IFC General EHS Guidelines cited in the Equator Principles are presented in the table below.

Table 9-2 WHO Ambient Air Quality Standards (µg/m³ unless otherwise specified)

PARAMETER	24 HOUR	ANNUAL
PM_{10}	100 (Interim target 2)	50 (Interim target 2)
	75 (Interim target 3)	30 (Interim target 3)
	50 (guideline)	20 (guideline)
$PM_{2.5}$	75 (Interim target 1)	35 (Interim target 1)
	50 (Interim target 2)	25 (Interim target 2)
	37.5 (Interim target 3)	15 (Interim target 3)
	25 (guideline)	10 (guideline)
NO_2	200 (1 hour)	40
SO_2	125 (Interim target 1)	500 (10-minute guideline)
	50 (Interim target 2)	
	20 (guideline)	
O_3	160 (interim target 1) (8-hour daily maximum)	
	100 (8 hour daily maximum guideline)	

Source: World Bank General EHS Guidelines, 2007

9.2 Baseline Conditions

9.2.1 100 MW PV power plant

Meteorological data to define wind conditions within the district was not available at the time of this assessment.

The 100 MW PV power plant site lies in a rural location situated 18 kilometres south-west of Samarkand city. Land-use within the site and surrounding landscape includes smallholder cultivation, livestock farming, residential establishments, and military base operations.

Observations made during field reconnaissance in and around the project site indicated the absence of any major influences on ambient air quality conditions, such as industrial stack emissions, open combustion, fugitive dust from major construction works, besides minor exhaust emissions and dust generation from vehicular transit along the A-378 highway and dirt

tracks extending over the site. Livestock herding and movement in and around the site can also contribute to transient dust generation in arid conditions.

Potentially sensitive receptors broadly identified in the vicinity of the 100 MW PV power plant site include the residential establishments within the communities of Chortut and Sazagan.

9.2.2 Nurobod BESS

The Nurobod BESS is situated in a rural location 13 kilometres south-west of Samarkand City. Land-use within the site and surrounding landscape includes crop farming, grazing, and poultry farming.

Observations made during field reconnaissance in and around the project site indicated the absence of any major influences on ambient air quality conditions, such as industrial stack emissions, open combustion and fugitive dust from major construction works, with the exception of the gravel and sand mining quarries located 780 metres west of the site. Minor and localized dust generation is driven by livestock herds grazing in and out of the sites, and transient exhaust emissions are a negligible contributor to ambient air quality. Livestock herding and movement in and around the site further contributes to transient dust generation in arid conditions.

Potentially sensitive receptors broadly identified in the vicinity of the site include a few residential and farming establishments within the communities of Dostlik MFY and Saroy.

9.2.2.1 Air quality monitoring

After the identification of nearby receptors, an air quality monitoring survey was carried out to (i) establish the baseline level of ambient air quality in relation to potential impacts, (ii) inform the development of commensurate mitigation measures and (iii) provide a frame of reference for construction-phase air quality monitoring. The survey was conducted between 14 and 15 September 2023 at a representative receptor location in the vicinity of the Nurobod BESS site, where fugitive dust was noted (from nearby agricultural activities and vehicle traffic). Quantitative air quality monitoring was not carried out at potential receptors located nearby the 100 MW PV power plant, as no notable existing air influences were not observed at these locations.

Table 9-3 Description of air quality monitoring location nearby the Nurobod BESS site

NOISE MONITORING LOCATION	DESCRIPTION	GPS COORDINATES	
		LATITUDE	LONGITUDE
AQ 01	Farm warehouse and shelter located South-West of the BESS site	39.57083687	66.73442638

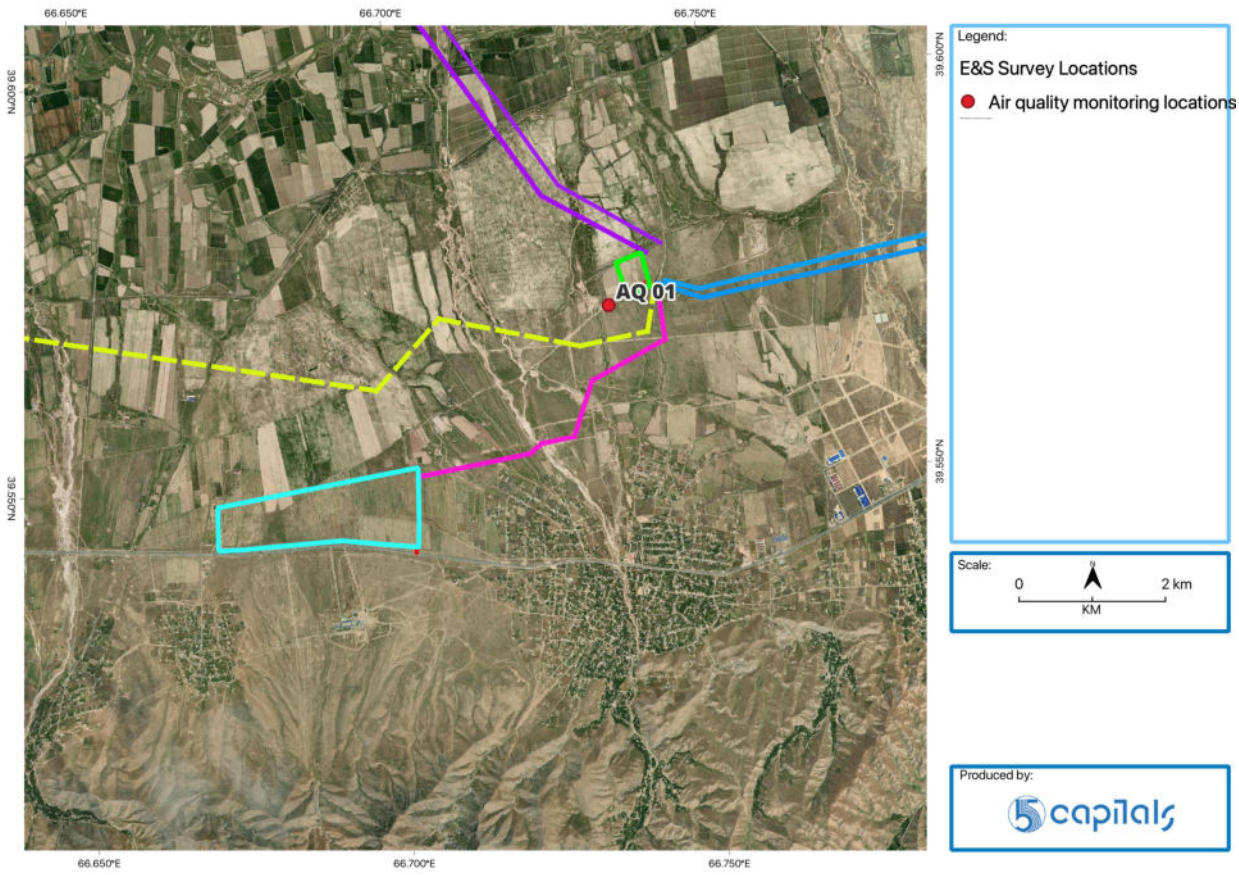


Figure 9-1 Air quality monitoring location nearby the Nurobod BESS site

Baseline ambient air quality measurements were made over continuous 24-hour durations, using an AQ Mesh gas analyser. Air quality parameters measured included concentrations of PM 2.5 and PM 10, and continuous monitoring results were logged at 15-minute intervals. Over the course of measurements, perceptible air quality influences were recorded in terms of their sources, frequency, and perceived impact.

9.2.2.2 Monitoring results

At the time of the measurements, the general wind direction was East, and the average recorded wind speed was 3.8 metres per second. The results of ambient air quality monitoring nearby the Nurobod BESS site are presented in the table below.

Table 9-4 Averaged results for air quality monitoring near the Nurobod BESS site

Parameter	Unit	Mean air concentrations (µg/m³)	National (SanPiN № 0293-11) standards (µg/m³)	WHO standards (µg/m³)
Carbon monoxide (CO)	µg/m³	8	4000	-

Parameter	Unit	Mean air concentrations (µg/m³)	National (SanPiN № 0293-11) standards (µg/m³)	WHO standards (µg/m³)
Carbon dioxide (CO_2)	µg/m³	710	-	-
Nitrogen oxide (NO)	µg/m³	0	250	-
Nitrogen dioxide (NO_2)	µg/m³	21	60	25
Sulphur dioxide (SO_2)	µg/m³	0	200	40
PM2.5	µg/m³	9	-	15
PM10	µg/m³	47	-	45

As shown in Table 9-4 , average results for all air quality parameters fall within national and WHO 24-hour guideline limits for air pollutants including particulate matter, with the exception of PM10, for which a slight exceedance was recorded.

Fluctuations in the concentrations of gaseous and particulate air pollutants at the monitoring location over the monitoring period are depicted in the figures below.

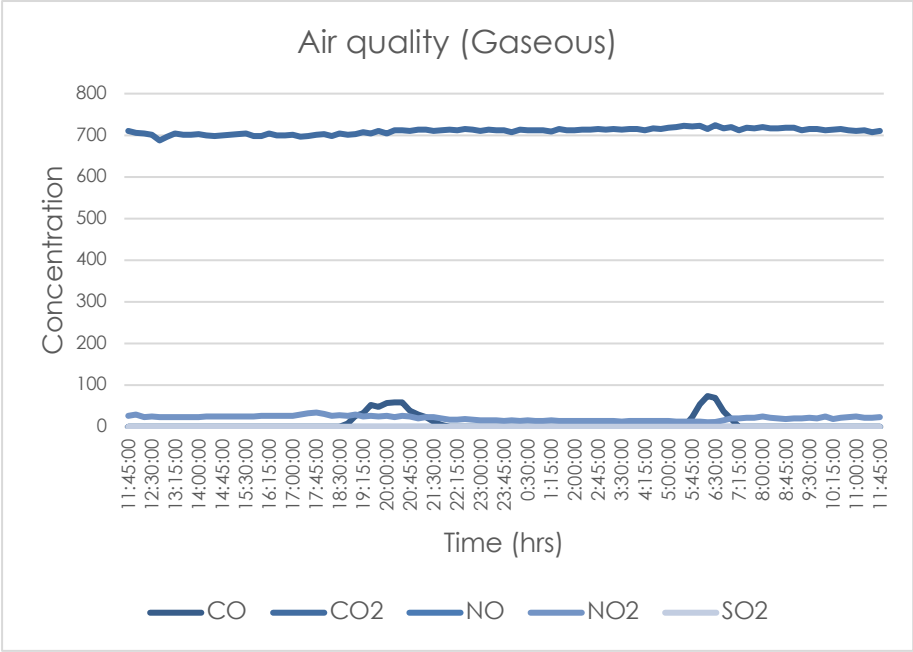


Figure 9-2 Variation in concentration of gaseous air pollutants nearby the Nurobod BESS site

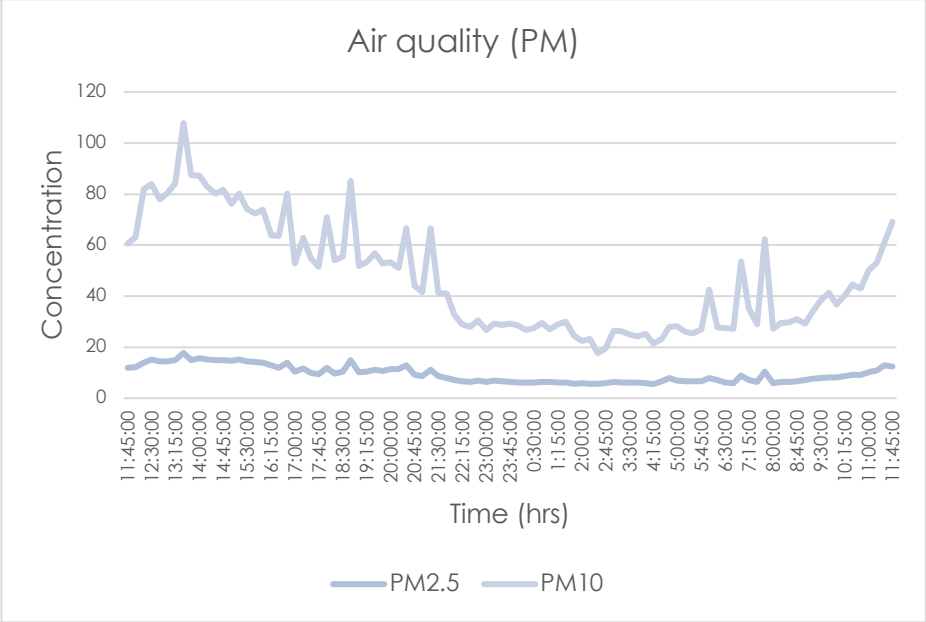


Figure 9-3 Variation in concentration of particulate air pollutants nearby the Nurobod BESS site

As shown in the figures above, ambient concentrations of gaseous air pollutants generally peak around 7 pm and 6 am, with maximum PM concentrations recorded between 11 am and 1 pm. The variability in ambient concentrations of these pollutants can be ascribed to vehicle traffic along the nearby dirt track, fluctuating wind speed, and to a lesser extent, wind-blown dust from the quarry site located West of the site.

9.2.3 400 MW PV power plant and pooling station

The 400 MW PV power plant and pooling station sites lie in a rural location situated 80 kilometres south-west of Samarkand city and 82 kilometres north-west of Shahrisabz City. Land-use within the site and surrounding landscape includes crop farming, grazing and residential establishments.

Observations made during field reconnaissance in and around the project site indicated the absence of any major influences on ambient air quality conditions, such as industrial stack emissions, open combustion and fugitive dust from major construction works. Minor and localized dust generation is associated with intensive herding in the dry seasons. Transient and minor levels of fugitive dust can also be attributed to infrequent vehicle passage along the dirt tracks connecting the resident communities of Chorvador and Olga.

Potentially sensitive receptors broadly identified in the vicinity of the sites include the residential establishments within the communities of Charvador and Olga.

9.2.3.1 Air quality monitoring

The air quality monitoring survey was conducted between 19 and 20 September 2023 at a representative receptor location in the vicinity of the pooling station and 400 MW PV plant sites.

Table 9-5 Description of air quality monitoring location nearby the pooling station and 400 MW PV plant and pooling station sites

NOISE MONITORING LOCATION	DESCRIPTION	GPS COORDINATES	
		LATITUDE	LONGITUDE
AQ 02	Nearest residential establishment South of the 400 MW PV plant and pooling station sites	39.42162129	65.96626005

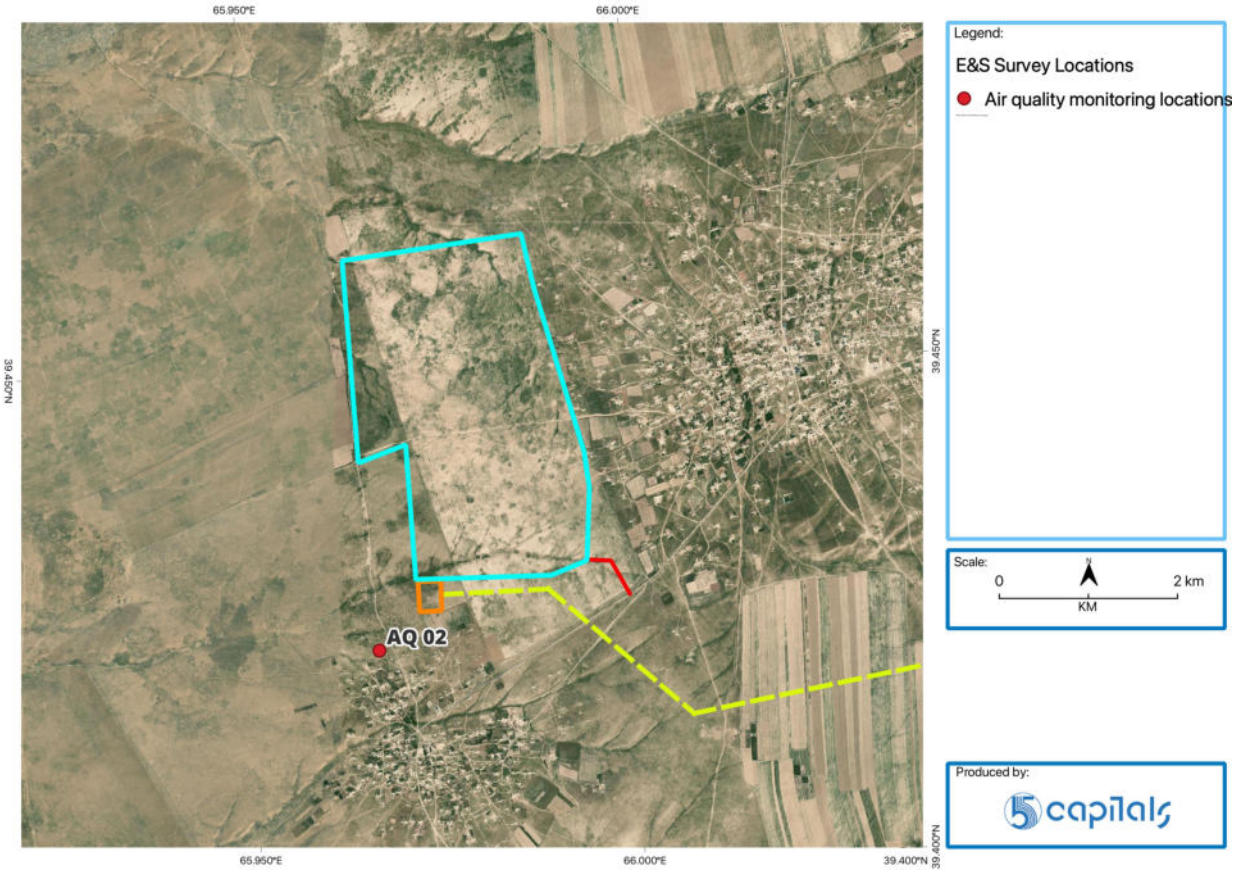


Figure 9-4 Air quality monitoring location nearby the 400 MW PV power plant and pooling station sites

Ambient noise monitoring was carried out using the methodology described in Section 9.2.2.1.

9.2.3.2 Monitoring results

At the time of the measurements, the general wind direction was South-East, and the average recorded wind speed was 1.8 metres per second. The results of ambient air quality monitoring nearby the pooling station and 400 MW PV plant sites are presented in Table 9-6 below.

Table 9-6 Averaged results for air quality monitoring near the 400 MW PV plant and pooling station sites

PARAMETER	UNIT	MEAN AIR CONCENTRATIONS (µG/M³)	NATIONAL (SANPIN № 0293-11) STANDARDS (µG/M³)	WHO STANDARDS (µG/M³)
Carbon monoxide (CO)	µg/m³	298	4000	-
Carbon dioxide (CO_2)	µg/m³	802	-	-
Nitrogen oxide (NO)	µg/m³	29	250	-
Nitrogen dioxide (NO_2)	µg/m³	34	60	25
Sulphur dioxide (SO_2)	µg/m³	3	200	40
PM2.5	µg/m³	10	-	15
PM10	µg/m³	11	-	45

As shown in Table 9-4 , average results for all air quality parameters fall within national and WHO 24-hour guideline limits for air pollutants including particulate matter, with the exception of Nitrogen dioxide, for which a slight exceedance was recorded relative to the WHO guideline value.

Fluctuations in the concentrations of gaseous and particulate air pollutants at the monitoring location over the monitoring period are depicted in the figures below.

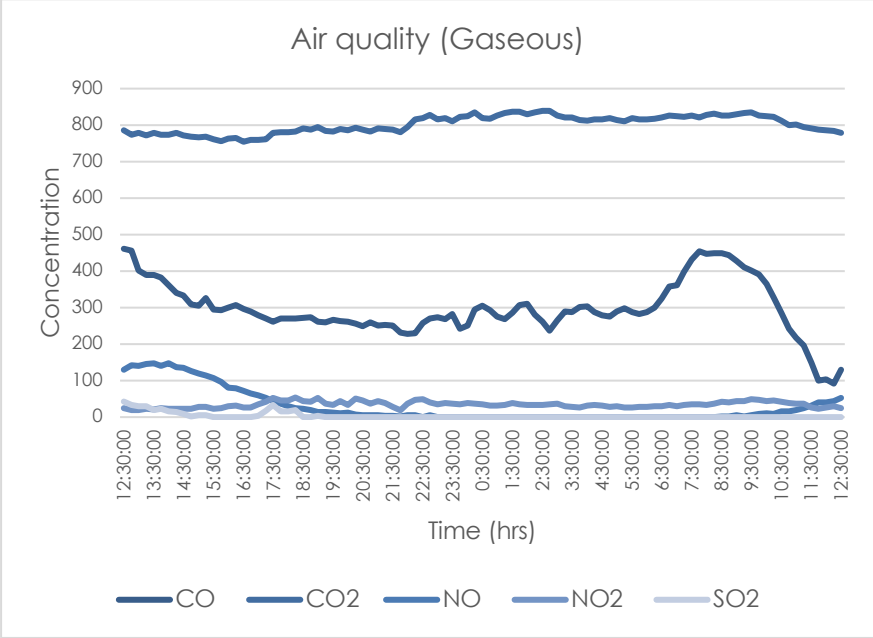


Figure 9-5 Variation in concentration of gaseous air pollutants nearby the pooling station and 400 MW PV plant sites

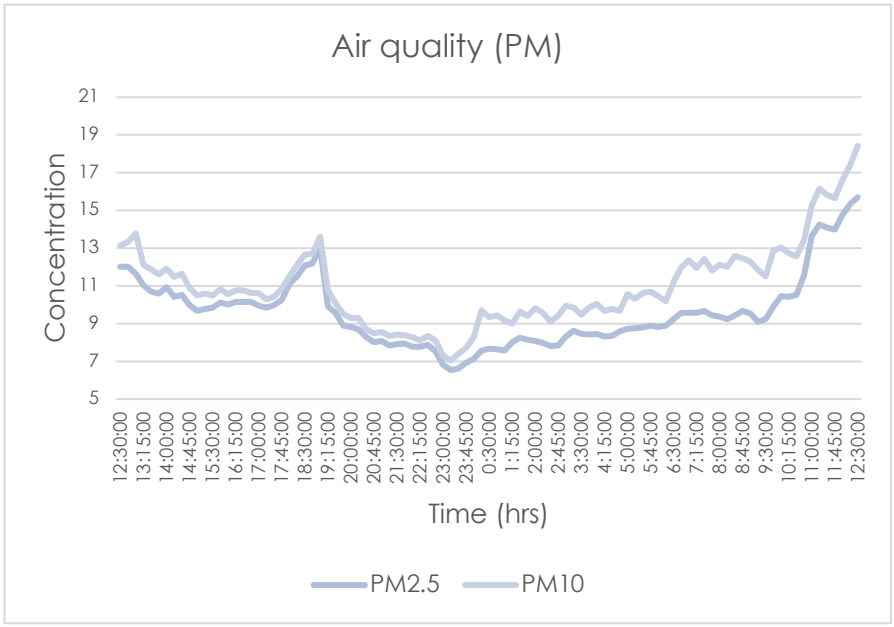


Figure 9-6 Variation in concentration of particulate air pollutants nearby the pooling station and 400 MW PV plant sites

As shown in the figures above, ambient concentrations of gaseous air pollutants generally peak around 8 am and 12 pm, with maximum PM concentrations recorded around 12 pm. The variability in ambient concentrations of these pollutants can be ascribed to herding along nearby stock routes, intermittent vehicle traffic, and fluctuating wind speed.

9.2.4 4.9 km OTL

The 4.9-km OTL corridor traverses a steppe landscape including grazing areas and small-scale crop farms. Observations made during field reconnaissance indicate that ambient air quality levels are relatively high in and around the corridor, with only minor and diffuse influence from sections located nearby the A378 highway and community tracks.

Potentially sensitive receptors broadly identified in the vicinity of the OTL include the residential establishments located within the communities (makhallas) of Sazagan and Saroy.

9.2.5 70 km OTL

The 70-km OTL corridor traverses an expanse of rural land with predominantly agricultural land-use. Observations made during field reconnaissance indicate that ambient air quality levels are relatively high in and around the corridor, with only minor and diffuse influence from sections intersecting and/or adjoining the A378 highway and community tracks.

Potentially sensitive receptors broadly identified in the vicinity of the OTL include the residential establishments located within the 12 affected communities (makhallas).

9.2.6 11-km and 19-km (LILO) OTLs

The LILO OTL corridors traverse largely agricultural landscape. The northerly end of the the 19-km OTL cut across a residential area that lies in the peri-urban outskirts of Juma Town. Observations made during field reconnaissance indicate that ambient air quality levels are relatively high in and around the corridor, with only minor and diffuse influence from sections intersecting community roads.

Potentially sensitive receptors broadly identified in the vicinity of the OTL include the residential buildings and farming establishments.

9.3 Receptors

The following table provides an overview of E&S impact receptors in the context of potential air quality impacts within the Project's Areas of Influence (AoI). A sensitivity rating and corresponding description is provided for each relevant receptor.

Table 9-7 E&S impact receptors – Air quality

RECEPTOR	SENSITIVITY	JUSTIFICATION
Construction workers	High	Construction workers have a potentially high sensitivity to the emission and dispersion of air pollutants (i.e., exhaust gases and PM) at close range.

RECEPTOR	SENSITIVITY	JUSTIFICATION
Residential and institutional establishments	High	Residents within nearby residential and institutional (schools, clinics, mosques etc.) establishments have a potentially high sensitivity to the emission and dispersion of air pollutants (i.e., exhaust gases and PM) at close range. Baseline levels of ambient air quality are generally high.
Commercial and establishments	Medium	Nearby commercial and industrial establishments have a potentially moderate sensitivity to the emission and dispersion of air pollutants (i.e., exhaust gases and PM) at close range, considering the current levels of vehicular traffic around these sites.
Flora	Low	Flora found in and around the PV plant and BESS sites is prone to dust smothering and desiccation. Flora of particular value and conservation concern on barren land within the sites include the closely situated crop farms and pastures in Nurobod District.

9.4 Potential Impacts and Management Measures

9.4.1 Construction phase

9.4.1.1 Elevated levels of ambient dust

The Project's construction phase will entail a host of site preparation activities and earthworks, including land clearance, excavation, grading, stockpiling as well as loading and off-loading of aggregates. Construction activities will also necessitate the circulation of heavy machinery, including Heavy Goods Vehicles (HGVs) within the project sites and along the Project's transit corridor. Construction-related traffic will include trips for the delivery and export of aggregate materials (e.g., backfilling and grading materials, excavation and site clearing spoils).

Earthworks, earth moving activities and the transportation of construction aggregates will result in the generation and dispersal of airborne dust. Dust generation, wind erosion and elevated levels of ambient dust levels pose the following adverse impacts on nearby residential, institutional, commercial and industrial receptors:

- Reduced visibility within impacted areas and associated health and safety hazards (e.g., traffic accidents along unpaved transit routes).
- Respiratory ailments and other health effects resulting from sustained dust dispersal.
- Soiling and smothering of nearby third-party assets (i.e., dust deposition on down-wind crop farms, aquacultural ponds, windows, roofing etc.).

Wind erosion and dust dispersal is likely to be significant within the PV plant and BESS sites, where extensive earthworks and movement of heavy machinery will be undertaken on arid, silty, barren land, over a considerable duration. Dust generation will also occur along dirt tracks

connecting to these sites. Severe dust generation and settlement in the vicinity of construction sites can impinge on the already vulnerable agriculture nearby the sites, and pastures.

The major to moderate significance of this potential impact can be lowered to a minor status, with the application of impact monitoring and proportionate mitigation measures, including dust monitoring at sensitive receptor locations, responsive dust suppression, and controls for dust-generating activities, including project traffic and haulage along unpaved access roads.

9.4.1.2 Elevated levels of ambient exhaust pollutants

The Project's construction phase will involve the operation of various motorized equipment and machinery. This includes heavy construction machinery, such as bulldozers, excavators, graders and cranes, light-duty vehicles, as well as HGVs for construction logistics. Construction activities may also necessitate the use of diesel-powered generator sets (due to remote location or prolonged power outages), for uninterrupted power supply during working hours.

The operation of fuel-powered equipment and machinery will generate exhaust emissions which will influence ambient air quality levels within immediately adjacent receptor locations. Any emissions from the construction vehicles, plant and equipment are expected to mix in ambient air close to the point of origin and are therefore likely to be discernible at sensitive receptor locations within 100 metres of construction site boundaries, particularly in the vicinity of the 100 MW and 400 MW PV plants, where residential establishments are located in close range.

Noxious exhaust emissions can have an adverse impact on human health, such as respiratory conditions, eye irritation, fatigue, and nausea.

9.4.1.3 Occupational exposure to air pollutants

Construction activities within the project sites will degrade ambient air quality due to the emission of exhaust (combustion) fumes, airborne dust as well as fugitive volatile pollutants and odours. While dust and exhaust emissions will be generated by sources described above, other emissions can lower air-quality within on-site construction facilities and workplaces. Noxious gases (i.e., hydrogen sulphide, methane, etc.) and offensive odours may pervade areas surrounding temporary facilities dedicated to the storage and transfer of putrescible, domestic waste, and sewage. Further, enclosed facilities dedicated to the storage of construction-related materials/ chemicals present fugitive emissions of toxic Volatile Organic Compounds (VOCs) (e.g., benzene, formaldehyde etc.). The expected range of impact from VOCs is likely to be less than 100m from source such as chemical storage areas, hazardous waste storage areas, etc.

The concentration of these pollutants is potentially highest at source locations within construction working areas. Construction workers are therefore subject to a comparatively

high exposure to construction-related air pollution, particularly within dust-prone areas where intensive earthworks will occur. Occupational exposure to high levels of airborne dust, exhaust fumes, VOCs and offensive odours poses a host of occupational health and safety risks, such as respiratory conditions, eye irritation, fatigue, nausea, carbon monoxide poisoning, and cumulative chronic conditions (i.e., cancers, anaemia, etc.).

Table 9-8 Overview of potential impacts relating to ambient air quality during construction

E&S IMPACT	AREA OF INFLUENCE	IMPACT MAGNITUDE	POTENTIAL RECEPTORS (DIRECT AND INDIRECT RECEPTORS)	RECEPTOR SENSITIVITY	PRE-MANAGEMENT IMPACT SIGNIFICANCE	RESIDUAL IMPACT SIGNIFICANCE
PV Plant and BESS Sites						
Elevated levels of ambient dust	Vicinity of the PV plant, BESS, and access road sites (discernible influence potentially extending to 350 metres from sources, as indicated in UK IAQN guidelines[5])	Moderate	Residential establishments	High	**Major**	**Minor**
			Commercial and industrial establishments	Medium	**Moderate**	**Minor**
		Low	Flora (including standing crops)	Medium	**Minor**	**Negligible**
Elevated levels of ambient exhaust pollutants	Vicinity of the PV plant, BESS, and access road sites (discernible influence potentially extending to 200 metres from sources, as indicated in UK DMRB guidelines[6])	Minor	Residential establishments	High	**Moderate**	**Minor**
			Commercial and industrial establishments	Medium	**Minor**	**Negligible**
Occupational exposure to air pollutants	Construction zones within the PV plant and BESS, and access road sites	Minor	Construction workers	High	**Moderate**	**Minor**
	Indoor and confined spaces for handling and storage of Volatile Organic Compounds (VOCs)					
	Vicinity of mobile toilets and storage facilities for domestic and putrescible waste within the PV plant and BESS sites (discernible influence potentially extending up to 100 metres from sources)					

[5] United Kingdom Institute of Air Quality Management

[6] United Kingdom Design Manual for Roads and Bridges.

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-management Impact Significance	Residual Impact Significance
OTL Sites						
Elevated levels of ambient dust	Vicinity of the OTL tower sites and access roads (discernible influence potentially extending to 350 metres from sources, as indicated in UK IAQN guidelines[7])	Moderate	Residential establishments	High	**Moderate**	**Minor**
			Commercial and industrial establishments	Medium	**Moderate**	**Minor**
Elevated levels of ambient exhaust pollutants	Vicinity of the OTL tower sites and access roads (discernible influence potentially extending to 200 metres from sources, as indicated in UK DMRB guidelines[8])	Minor	Residential establishments	High	**Minor**	**Minor**
			Commercial and industrial establishments	Medium	**Minor**	**Negligible**
Occupational exposure to air pollutants	Vicinity of the OTL tower sites	Moderate	Construction workers	High	**Moderate**	**Negligible**
	Vicinity of mobile toilets at OTL sites (discernible influence potentially extending up to 100 metres from sources)					

Impact Avoidance and Mitigation Measures

Elevated levels of ambient dust

- Weather forecasts will be monitored to identify periods with strong wind conditions and allow provisions for commensurate dust suppression measures within any arid sites prone to dust generation.
- Any land grading and excavations within any arid and dust-prone areas within the project sites will be avoided during strong hot, dry, and substantially windy weather conditions.
- Cement and other fine powders will be sealed after use or put in bunded containers at appropriate, sheltered storage sites.
- Internal roads inside the project site will be compacted to ease navigation and reduce vehicular power consumption.

[7] United Kingdom Institute of Air Quality Management

[8] United Kingdom Design Manual for Roads and Bridges.

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-management Impact Significance	Residual Impact Significance
• Only designated access tracks will be used for project traffic, and internal access roads will be demarcated and signposted as necessary, to maximize compaction and reduce the ground-damping zone for dust suppression. • Where sand and other aggregates are transported to or from the site, trucks will not be overloaded and will be appropriately covered/sheeted to avoid loses and dust dispersal en-route. • Vehicle speed on all site roads and along the access road into the site will be restricted to 20 km/hour. • Exhaust emissions from trucks and vehicles will be minimised by ensuring the use of good condition vehicles (e.g., compliant to vehicle emission requirements). There will be pre-requisite requirements of site vehicles to ensure no black smoke before entering site and that any identified machinery or vehicles with black smoke will require maintenance and re-assessment before it is returned. • Heavy goods/ haulage vehicle engines will be turned off during drop-off and pick-up waiting time, to minimize gaseous emissions. Air-conditioned/heated shelters will be provided for drivers in designated waiting, loading and unloading areas to prevent drivers waiting in vehicles. • Regular damping down of any unpaved access tracks and dust-prone construction working areas, to minimize the generation and re-suspension of air-borne dust. • The frequency of ground wetting shall be increased in the event that dust monitoring and/or community and worker grievances indicate substantial exceedances of the threshold for ambient dust/ PM concentration. • Dust protection nets will be installed in in the event of limited availability of water for wet dust suppression at the 100 MW PV plant, 400 MW PV and Nurobod BESS sites, during earthworks over dry and windy periods with excessive dust conditions. • Continual, on-site supervision will be provided to ensure that the height of excavated soil unloading/ drop-off is minimized, particularly during dry, and windy conditions. • In the event that a batching plant is installed within any of the project sites, all necessary permits related to the construction and operation of the batching plants will be secured. • Adaptive dust suppression is carried out in a manner that is commensurate with dust conditions. • Provide project workers with full PPE kit including dust masks, and goggles where appropriate. • Open burning of solid waste (including vegetation clearance debris) within the project sites will be proscribed. • Advance notices will be provided to sensitive residential and commercial establishments within communities located nearby the project sites as early as possible (minimum one-week notice) in the event of intensive earthworks within dust-prone areas under arid and high-wind conditions. • Aggregate stockpiles (i.e., any find sand, cement etc.) and dust generating activities will be sited away from the site boundaries and/or isolated using barriers such as fencing or vegetation screens to minimize dust dispersal. • Relevant risk assessment will be conducted following the ESIA, in the event that any dust-prone zones of concern are identified during site inspection, and dedicated monitoring locations will be established within such hotspots.						

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-management Impact Significance	Residual Impact Significance
• Based on the ESIA and any follow-up risk assessment, the EPC Contractor will develop and implement an (i) Air Quality and Emissions Management Plan, (ii) Soil Management and Erosion Control Plan, and (iii) Traffic Management Plan, and incorporate these Plans into all relevant method statements. **<u>Elevated levels of ambient exhaust pollutants</u>** • Only designated access tracks will be used for project traffic, and internal access roads will be demarcated and signposted as necessary, to maximize compaction and reduce the ground-damping zone for dust suppression. • Only designated access tracks will be used for project traffic, and internal access roads will be demarcated and signposted as necessary. • Vehicle speed on all site roads and along the access road into the site will be restricted to 20 km/hour. • Unnecessary usage of vehicles, plant and equipment will be minimised, and unnecessary idling of vehicles and plant will be avoided. • Deliveries of equipment/plant to the site will be efficiently managed to reduce the number of trips. • Exhaust emissions from trucks and vehicles will be minimised by ensuring the use of good condition vehicles (e.g., compliant to vehicle emission requirements). There will be pre-requisite requirements of site vehicles to ensure no black smoke before entering site and that any identified machinery or vehicles with black smoke will require maintenance and re-assessment before it is returned. • Low-sulphur diesel fuel will be used, if available, through the local supply chains. • Heavy goods/ haulage vehicle engines will be turned off during drop-off and pick-up waiting time, to minimize gaseous emissions. • Air-conditioned/heated shelters will be provided for drivers in designated waiting, loading, and unloading areas to prevent drivers waiting in vehicles. **<u>Exposure to occupational air pollutants</u>** • Hazardous materials stored and used on site with potential gas emissions (e.g. Volatile Organic Compounds) will be located in well-ventilated, but secure low-risk areas, away from major transport routes and away from the site boundary and receptors locations (where feasible). • Volatile fuels and chemicals (including hazardous wastes) will be stored in sealed containers. On site storage of large quantities of volatile fuels will be avoided, equally prolonged exposure to direct sun and heat will be avoided. • Open burning of waste will be strictly prohibited. • Chemical storage areas will be purpose built and well maintained. A data log of all chemicals with MSDSs will be provided at the storage facility within easy access. • The management measures specified above will be implemented to minimize occupational exposure to airborne dust and exhaust pollutants. • Adequate and well-equipped sanitary facilities will be established within the project sites (with sufficient flush water).						

E&S Impact	Area of Influence	Impact Magnitude	Potential Receptors (direct and indirect receptors)	Receptor Sensitivity	Pre-Management Impact Significance	Residual Impact Significance
• Effective cleaning and maintenance of toilets will be undertaken to avoid congestion, backflow, and emanation of strong septic odours. Cleaning records/inspection sheets will be displayed in the toilets for purposes of monitoring. • All septic tanks must be sealed (with applicable vents) and fully functioning. • Septic tanks must be operated and maintained according to manufacturer recommendations. • Sanitary wastewater will be removed from site by licensed contractors and disposed in waste treatment facilities approved by the local municipality. • Where possible, all sanitary facilities and septic tanks will be sited away from receptor locations. • Organic, putrescent domestic waste from on-site kitchen/ canteen areas will be collected, segregated, and stored at designated facilities that are sited away from workstations and site boundaries (where receptors are immediately adjacent to the site). • Organic, putrescent waste will be picked up from designated storage areas on a sufficiently regular basis by licensed waste management service providers. • Adequate haulage vehicles will be used for the pick-up and transportation of solid waste and wastewater from the project sites.						

9.4.2 Operational phase

Impacts on ambient air quality are not expected to occur in the Project's operational phase and are therefore excluded from the assessment.

9.4.3 Decommissioning phase

Project decommissioning will entail the deconstruction of project facilities, demobilization of related equipment and materials, as well as potential repurposing and/or rehabilitation works. At this stage, potential impacts relating to air quality and carbon emissions will be similar to the above-described construction-phase impacts. Specifically, this set of impacts potentially includes:

- Elevated levels of ambient dust
- Elevated levels of ambient exhaust pollutants
- Occupational exposure to air pollutants

For the avoidance and mitigation of these impacts, relevant impact management measures specified in Section 9.4.1 will be implemented. Accordingly, the same pre-management and residual significance ratings are provisionally assigned to mutually relevant impacts on sensitive receptors.

9.5 Monitoring Requirements

Table 9-9 below provides an overview of the key monitoring arrangements for evaluating performance against applicable standards relating to ambient air quality and carbon emissions, in the Project's construction and operational phases. A more elaborate coverage of these requirements will be provided in the Construction- and Operations-phase Environmental and Social Management Plans (C-ESMP, O-ESMP) and Environmental and Social Monitoring Plans (ESMoPs).

Table 9-9 Monitoring arrangements for impacts and preventative and mitigation measures relating to ambient air quality and carbon emissions

E&S Impact	Key Performance Indicator/ Parameter	target	Monitoring Location / Means of Verification	Monitoring Frequency	Responsible Entity
Elevated levels of ambient dust	Grievances regarding construction dust	No grievances regarding construction dust	- Air quality monitoring locations targeted for ESIA baseline survey	Daily	- EPC Contractor Environmental Officer
	$PM_{2.5}$	15 µg/m^3		Monthly	- EPC Contractor Environmental Officer
	PM_{10}	45 µg/m^3			
	Dust suppression measures (PV plant, BESS, and access road sites)	Evidence of dust suppression by damping down, speed limits and covering of hauled aggregate loads	- Construction zones, laydown areas, dirt access tracks	During periods of high activity and arid/windy conditions; Upon grievances related to dust	- EPC Contractor Environmental Officer
	Grievances concerning dust conditions	All related grievances are closed out within the shortest practicable duration	- Community and Worker Grievance Logs	Ongoing	- EPC Contractor HR Officer
Occupational exposure to air pollution	Visual assessment of emissions to be undertaken while vehicles and equipment are in use;	No visual observation of black smoke	- All non-road vehicles and engines	Ongoing	- EPC Contractor Environmental Officer
	Third-party inspection of vehicles, including inspection during the initial acceptance criteria of such vehicles to site.	Records of periodic inspection and maintenance	All non-road vehicles and engines	Annually	

E&S Impact	Key Performance Indicator/ Parameter	target	Monitoring Location / Means of Verification	Monitoring Frequency	Responsible Entity
	Grievances concerning offensive odours (i.e., VOCs etc.)	All related grievances are closed out within the shortest practicable duration	- Worker Grievance Logs	Ongoing	- EPC Contractor CLOs

10 BIODIVERSITY

10.1 Legal Requirements and Standards

10.1.1 National laws and regulations

THE LAW OF THE REPUBLIC OF UZBEKISTAN "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 organisational basis for the conservation of the environment and the rational use of natural resources. Article 25 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.

THE LAW OF THE REPUBLIC OF UZBEKISTAN "ON PROTECTED NATURAL RESERVES" (2004) AS AMENDED IN 2020

This law regulates the use and protection of protected natural territories. The main aim is to ensure preservation of typical, unique, genetic banks of plants and animals, prevent negative impact of human activities on nature, promote the study of natural processes and monitoring of the environment including promotion of environmental education.

THE LAW OF THE REPUBLIC OF UZBEKISTAN "ON PROTECTION AND USE OF THE WILDLIFE" (1997) AS AMENDED IN 2016

This law regulates the use, protection, reproduction and restoration of wildlife in order to promote conservation and ensure diversity of species in their natural habitat.

Other laws and regulations include:

- The Law of the Republic of Uzbekistan "On Protection and Use of Vegetation" (1997) as amended in 2021.
- Decree of the Cabinet of Ministers "Regulation on the procedure for using plant world objects and passing licensing procedures in the field of using plant world objects" No. 290 of 10.10.2014 as amended in 2020. The law sets out the requirements to obtain permission to cut wood and shrub plantations that are in the zone of the construction site.

10.1.2 Lender Requirements

10.1.2.1 ADB

An element of the ADB Safeguard Requirement 1: Environment covers 'Biodiversity Conservation and Sustainable Natural Resource Management'.

It is stated that, 'The borrower/client will assess the significance of project impacts and risks on biodiversity and natural resources as an integral part of the environmental assessment process. The assessment will focus on the major threats to biodiversity, which include destruction of habitat'. Further, 'The borrower/client will need to identify measures to avoid, minimize, or mitigate potentially adverse impacts and risks.

The Standard also states that 'the borrower/client will exercise care to minimize any further conversion or degradation of such habitat, and will, depending on the nature and scale of the project, identify opportunities to enhance habitat and protect and conserve biodiversity as part of project operations.'

10.1.2.2 EPFIs

The assessment of impacts upon terrestrial ecology is required to meet the requirements set out in the IFC Performance Standard 6 on Biodiversity Conservation and Sustainable Natural Resource Management. The IFCPS6 establishes requirements for protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources.

10.2 Critical Habitat

10.2.1 Introduction

The concept of Critical Habitat is widely utilized and the principles for protection of critical habitat widely applied by DFIs. A specific screening and assessment process is undertaken to identify if any CH criteria are triggered by the project. This requires scoping to assess potential species candidates for triggering CH, and subsequently using information obtained from surveys, secondary sources, and stakeholders to extrapolate a population estimate for the individual species/species group's "Ecologically Appropriate Area of Analysis" which may in many cases be overlapping but not 100% aligned with a project impacts' Area of Influence. If any extrapolated population estimates (extrapolated from existing information across the qualified EAAA) meet the appropriate CH thresholds, then CH will have been triggered.

The below provides an overview of all applicable criteria as per IFC and ADB:

- IFC PS6 Criterion 1: Critically Endangered and Endangered Species /// ADB criterion "habitat required for the survival of critically endangered or endangered species";
- IFC PS6 Criterion 2: Endemic and Restricted-range Species /// ADB criterion "areas with special significance for endemic or restricted-range species";
- IFC PS6 Criterion 3: Migratory and Congregatory Species /// ADB criteria "sites that are critical for the survival of migratory species" and "areas supporting

globally significant concentrations or numbers of individuals of congregatory species";

- IFC PS6 Criterion 4: Highly Threatened or Unique Ecosystems
- IFC PS6 Criterion 5: Key Evolutionary Processes /// ADB criterion "areas with unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services";
- Additionally, ADB criterion "areas with biodiversity that has significant social, cultural or economic importance to local communities"

Some of the CH criteria listed above have quantitative thresholds associated with them, defined in lender policy, while others can only be assessed using more qualitative evaluation of the criterion.

10.2.2 Significant Biodiversity Values

Natural habitat and species may still be of elevated concern even if critical thresholds are not met. Significant biodiversity values (SBVs) may include species of conservation concern (for example, species that are threatened, legally protected, or otherwise identified as important by stakeholders) and ecological features in the landscape that are important to stakeholders. SBVs may occur in natural or modified habitat.

10.2.3 No Net Loss and Net Gain

In all areas of natural habitat, regardless of the prospects of significant conversion and degradation, the project should design and implement mitigation measures to achieve no net loss of biodiversity, where feasible, through the application of various on-site and offset mitigation measures. (Where it is not considered feasible, the project will document the technical, financial or other reasons why achieving no net loss is not feasible.)

No Net Loss (NNL) does not mean zero loss. NNL is achieved when project-related impacts on biodiversity are balanced by measures to avoid and minimize impacts, conduct on-site restoration, and offset significant residual impacts on an appropriate geographic scale (e.g., local, landscape-level, national, regional).

Projects will not lead to a net reduction in IUCN CR and EN listed species on the global and/or the regional/national scale.

Net reduction is a singular or cumulative loss of individuals that impacts on the species' ability to persist at the global and/or regional/national scales for many generations or over a long period of time. The scale (i.e., global and/or regional/national) of the potential net reduction is determined based on the species' listing on either the (global) IUCN Red List and/or on regional/national lists. For species listed on both the (global) IUCN Red List and the national/regional lists, the net reduction will be based on the national/regional population.

In areas of critical habitat, the project will be expected to demonstrate net gains in biodiversity values for which the critical habitat was designated.

Net gains may be achieved through the biodiversity offset. Net gains of biodiversity values must involve measurable, additional conservation outcomes. Such gains must be demonstrated on an appropriate geographic scale (e.g., local, landscape-level, national, regional) as determined by external experts. In instances where a biodiversity offset is not part of the client's mitigation strategy (i.e., there are no significant residual impacts), net gains may be obtained by supporting additional opportunities to conserve the critical habitat values in question. In these cases, qualitative evidence and expert opinion may be sufficient to validate a net gain.

10.2.4 CHA Methodology

A desktop-based screening exercise was undertaken as the preliminary step to a Critical Habitat Assessment. The results of the screening exercise indicated which species should be investigated more thoroughly in order to determine if any thresholds might be surpassed which would trigger the designation of critical habitat. The findings of the screening exercise not only support the scoping report but help to determine the required baseline study methodology as well as stakeholder engagement and other collation of information sources.

Subsequent literature reviews, stakeholder engagement, survey data collation, and analysis were undertaken, culminating in the CHA Report.

Please refer to the Samarkand 1 PV Main Facilities CHA Report for the full assessment.

10.2.5 CHA Results

Whilst no species were found to trigger CH, a total of five species were classified as Significant Biodiversity Values (SBVs). SBVs refers to threatened and nationally protected species identified during the CHA process that do not meet IFC thresholds for criticality but however trigger IFC requirements of No Net Loss (NNL). The SBV's will be assessed within the ESIA as Sensitive Receptors (SRs) for which biodiversity mitigation measures will be in implemented throughout the different phases of the project to achieve NNL.

The following table lists the species that have been designated as Significant Biodiversity Values.

Table 10-1 Significant Biodiversity Values

COMMON NAME	CRITERION 1 (IFC)
Egyptian Vulture (observed in Autumn 2023 and Spring 2024 VP surveys)	✓ IUCN EN Status triggers SBV

Steppe Eagle (observed in Autumn 2023 and Spring 2024 VP surveys)	✓ IUCN EN Status triggers SBV
Great Bustard (considered possible within the Nurobod BESS and 70km OTL surveys)	✓ IUCN EN Status triggers SBV
Eastern Imperial Eagle observed in Autumn 2023 and Spring 2024 VP surveys)	✓ IUCN VU Status triggers SBV
Central Asian Tortoise (observed across the Project site)	✓ IUCN VU Status triggers SBV

The following sections and sub-sections provide an overview of the surveys undertaken to establish baseline terrestrial ecological conditions of the site.

10.3 Baseline Conditions

10.3.1 Spatial Context

10.3.1.1 Regional

The UZB-ACWA-Samarkand Solar Project (including associated substations and OTLs) is located in the Samarkand Region of Eastern Uzbekistan, extending North through the regions of Jizzakh, Sirdaryo and Tashkent. Unlike much of the desert dominated landscape of West and Central Uzbekistan, Eastern Uzbekistan is characterised by plains, mountains and valley habitats. It has a cold semi-arid climate with hot, dry summers (June – August) where temperatures can reach 40oC, and variable winters (November – January) where temperatures can drop below freezing.

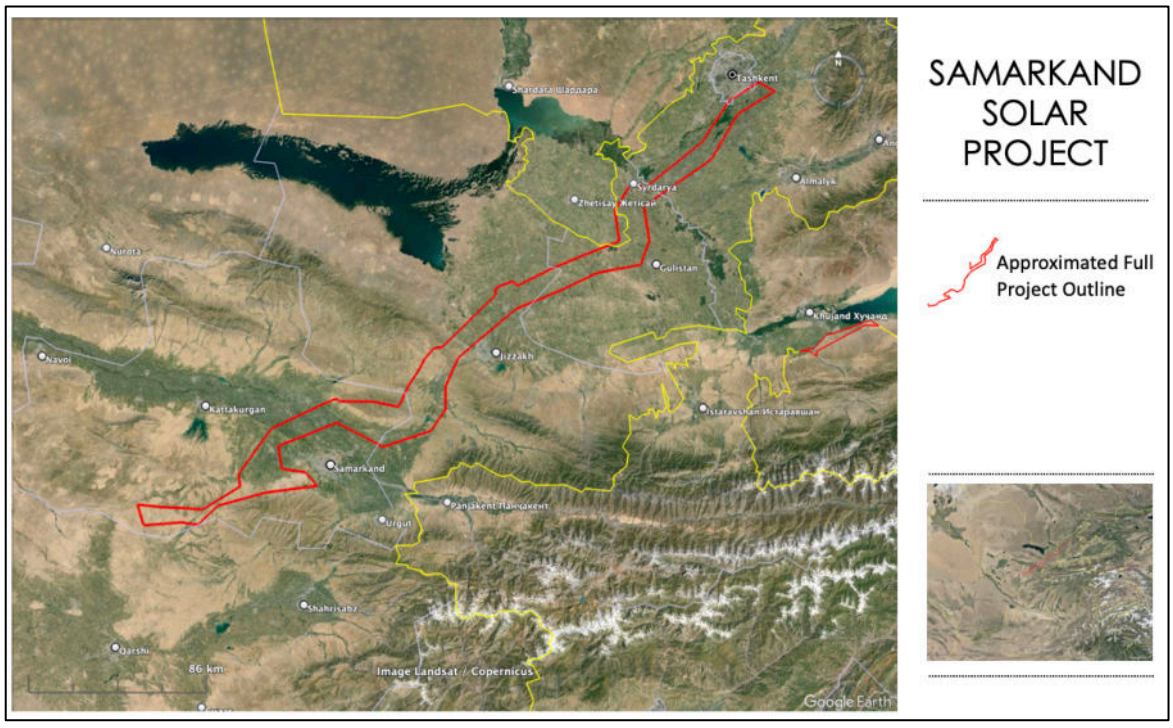


Figure 10-1 Regional context of Samarkand Solar Project

Mountain ranges border much of Eastern Uzbekistan, notably the Tian Shan Range near Tashkent which stretches 2,900 km eastward and the smaller Nuratau mountains to the Northwest of Samarkand. The region has two main rivers further shaping its landscape; the Zarafshan river, where the Samarkand region sits within the fertile Zarafshan Valley; and the Syr Darya which crosses the Sidaryo region. Due to historic damming of the Syr Darya, a large 4,000km2 system of manmade Lakes, known as Ayadar Lake, is situated to the West of Sidaryo. The landscape North of Samarkand, extending up to Tashkent, is dominated by plains. Semi-arid grassland habitats, known as 'steppe', are found across the region, including the Mirzacho'l, a 10,000km2 loess plain on the left bank of the Syr Darya, and smaller areas of protected habitats such as Karnabchul Steppe near Samarkand.

These geological features have created a diverse mix of habitats within the region, including rocky foothills, steep cliffs, steppe plains and riparian habitats.

10.3.1.2 Ecosystems and Habitats

Within the framework of the UZB-ACWA-Samarkand Solar Project, a comprehensive habitat assessment was conducted, leveraging the IUCN Habitats Classification Scheme and EUNIS habitat classification to delineate and understand the varied habitats spanning the project area. This summary encapsulates the habitat types identified across various project sites, reflecting a blend of modified and natural environments shaped by both human activity and inherent ecological processes.

The 100 MW PV plant area is distinguished by arable lands utilized for the cultivation of agricultural crops such as wheat, barley, and safflower, alongside fallow lands that have returned to a natural state with a community of grasses, annual and perennial weeds, and notable species like camel thorn and caper. Surrounding areas feature fruit gardens and vineyards, harbouring a variety of fruit trees and understory vegetation, and dry grasslands representing temperate grassland habitats with a mix of forb-grass communities, indicative of overgrazing impacts.

At the Nurabad BESS, fallow lands predominate, characterized by a sparse vegetation cover comprising mainly bluegrass and camel thorn communities, with occasional harmel and Cousinia resinosa. These areas, reflecting a history of agricultural use followed by abandonment, currently serve as pasture lands.

The 400 MW PV plant site mirrors the habitat diversity seen at the 100 MW plant, with the addition of dry grasslands situated among fallow lands. These grasslands are vital for local pastoral activities, yet they exhibit signs of degradation, largely attributable to overgrazing.

Natural habitats along the 70 km OTL corridor, such as dry grasslands and the dry beds of temporary streams, highlight the interplay between natural ecological processes and

anthropogenic pressures, including the consequences of overgrazing and gravel extraction on habitat integrity.

These habitat assessments paint a picture of a landscape deeply intertwined with human activity, where agricultural practices, pastural usage, and infrastructural developments have shaped the ecological character of the region. The presence of modified habitats alongside patches of natural environments underscores the need for integrated management approaches that balance development objectives with conservation imperatives.

10.3.1.3 Landscape-Level Connectivity, Context and Conditions

The Tashkent Region, nestled in the northeastern part of Uzbekistan, spans approximately 15.3 thousand km² and houses nearly 3 million residents, reflecting an average population density of around 200 people per km². Geographically, it divides into the alluvial-proluvial plains along the right bank of the Syrdarya River's middle reaches, and the Western Tien Shan mountain ranges.

The Syrdarya Region lies in central Uzbekistan, along the left bank of the Syrdarya River, covering an area of 4.276 thousand km², with a population of approximately 896.6 thousand. The region, part of the alluvial-proluvial plain known as the Hungry Steppe, has transformed from a near-desert landscape to one dominated by agricultural and urban development, with its elevation ranging from 230 to 395 m above sea level.

The Dzhizak Region, situated in central Uzbekistan, encompasses 21.21 thousand km² and supports a population of about 1.475 million. This region is characterized by diverse landscapes, from the desert and lakes of the northern plains to the Turkestan Ridge and Nuratau mountains in the south. The Nuratau Mountains, featuring rugged northern slopes and gentler southern terrains, stand as one of Central Asia's oldest mountain ranges.

Lastly, the Samarkand Region is located in central Uzbekistan, within the Zeravshan River basin. Covering 16.77 thousand km², it is home to roughly 4.1 million people. The region's geography includes both plains and mountains, with the fertile Zeravshan valley and its surrounding piedmont plains highlighting the region's ancient agricultural heritage. Almost the entire valley now showcases an anthropogenic landscape, albeit with remnants of its original floodplain ecosystems.

Together, these regions encapsulate a rich tapestry of Uzbekistan's physical geography, ranging from fertile oases and rugged mountain ranges to transformed steppes, each contributing to the diverse ecological and cultural fabric of the nation.

10.3.2 Seasonality

Uzbekistan is defined by four main seasons (spring, summer, autumn and winter). The general weather characteristics of the region can be described as cold winters with hot summers. Generally, the precipitations are highest in winter and spring, with summer being the driest period of the year.

Spring typically commences at the end of February / beginning of March and concludes in May. This period is characterised by sudden changes in weather from cold, heavy rains to warm, sunny days. Summer commences around May/June and concludes around August/September. As mentioned previously, this is the driest and hottest time of the year. Autumn spans from September/October to November/December and levels of precipitation increase during this period. Lastly, winter spans from December to February, and this period is characterised by low temperatures and high levels of precipitation.

As with the season, biodiversity elements have cyclical activities that correspond to different times of the year. Most notably, the annual movement and migration of birds correspond to spring and autumn seasons. Uzbekistan is located in the Central Asian migratory flyway, which is in close proximity to the West Asian- East African and Black Sea Mediterranean flyways.

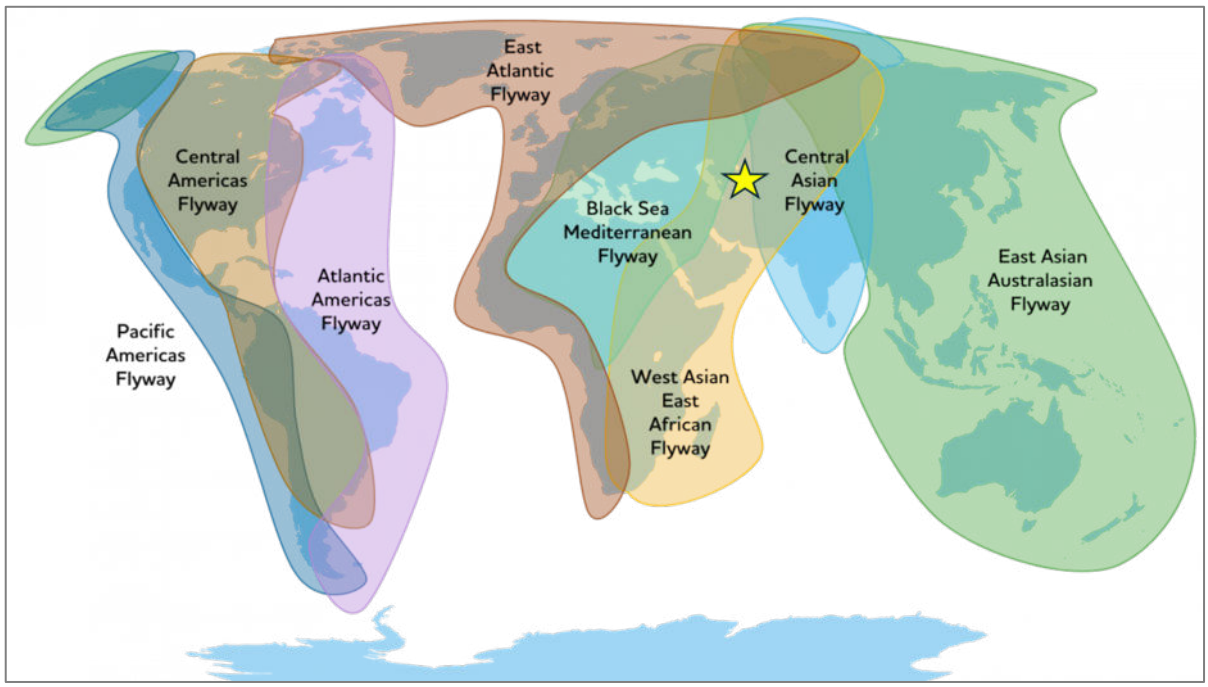


Figure 10-2 Global Migratory Flyways

The Central Asian flyway is one of the major flyways that covers a large continental area between Eurasia and the Arctic and Indian Oceans. The birds that make use of the flyway move back and forth from the breeding grounds (Russian Federation and Siberia) to the non-breeding/wintering ground in West and South Asia, Maldives, etc. This migration occurs

annually, with a large number of birds moving South in spring and back Northward in autumn. While on the long migration, many bird are likely to make stop-overs along their migration route, and thus there is an influx of migrating bird species at such stopover sites between spring and autumn. Different types of birds undertake migration every year, and in the case of the central Asian flyway, many of these birds are waterbirds, all of which are dependent on wetland for breeding, stop-over and wintering sites.

Birds are however not the only animal that migrates. Bats have been known to migrate throughout the area of Uzbekistan. The most common species, the Common Pipistrelle (Pipistrellus pipistrellus), is a migratory species. Many other bat species are known to migrate, however research is much more restricted when compared to bird migrations. In general bat activity is restricted to warmer months and there is little activity during the coldest months of winter.

In addition to cyclical migrations, there are other annual activities undertaken by regional biodiversity elements. An example of this is the increase in reptile activities that occur between spring and summer. The increase in temperatures result in higher diurnal and nocturnal reptile activity. For some reptiles, such as Horsfield tortoise (Testudo horsefieldii) this period of activity is limited only to only three months (March – May) (Theile, 2000). This tortoise species spends most of its time hibernating and aestivating in underground burrows. Similarly, there is a decline in reptile activity as temperatures drop in autumn and winter.

Vegetation has similar annual cycles, particularly ephemeral species. Such species often emerge following periods of rain. Ephemeral species can often times be found in semi-desert areas. These species have very short life cycles and are often abundant immediately following suitable conditions, and are often not present for sustained periods of extreme weather such as summer and winter. In general, spring (March – May) is the period in which the majority of floral species will flower, which in turn has a positive impact on invertebrate communities.

10.3.3 Recognized Biodiversity Areas

The following section presents a detailed overview of recognized Protected Areas (PAs), State- and nationally-designated reserves, and Important Bird Areas (IBAs)/Key Biodiversity Areas (KBAs), emphasizing their geographical proximity to the project sites, area coverage, conservation status, and the ecological roles they play.

The following sections include a complete overview of the recognized areas that lie near Samarkand 1 project facilities including the associated Overhead Transmission Lines (OTLs).

The below are government designated areas, referred to as sanctuaries, reserves, or otherwise protected areas.

- Mubarek State Wildlife Sanctuary (Category IV of IUCN, 264 thousand Ha, 1.5km from 400MW).
- Zeravshan National Park (category II of IUCN, 2.426 thousand ha, 20km South of 11km LILO).
- Nurobod wildlife sanctuary (category IV of IUCN, 40.0 thousand ha, 20 km to the west of 400 MW PV)
- Omankutan National Nature Park (Category II of IUCN, 15.0 thousand Ha,30km South of 100 MW PV Plant)
- Kushrabad wildlife sanctuary (category IV of IUCN, 16.5 thousand ha, 55km from 19km LILO)
- Kitab Geological National Nature Park (category II of IUCN, 39.38 thousand ha, 55km Southeast of 11km LILO)
- Зеравшанский (category IV of IUCN, 23 thousand ha, 65km East of 11km LILO)
- Hissar State Reserve (Category 1a of IUCN, 809.86 thousand ha, 85km Southeast of 11km LILO)
- Tudakul and Kuymazar Water Reservoirs (category VI of IUCN, 32 thousand ha, 94km Northwest of 100MW PV Plant)

The following table outlines additional Important Bird Areas (IBA's) and Key Biodiversity Areas (KBA's) near the Project Main Facilities.

Table 10-2 Summary of KBA and IBAs near to the Proposed Project Site

NAME	SIZE	DESIGNATION	NOTABLE HABITATS AND SPECIES	PROXIMITY TO PROJECT
Kattakurgan Reservoir	2,600 Ha	Key Biodiversity Area (KBA Partnership) Important Bird Area (Birdlife)	Reservoir providing a key habitat for many resident, breeding and migrant birds. Siberian Crane (CR), Asian Houbara (VU) and other waterbirds including the Demoiselle Crane	26km from 70km OTL
Karnabchul Steppe	177,156 Ha	Important Bird Area (Birdlife)	The IBA includes various key habitats: desert, saline lakes and marshlands, shrubs. The area is used for grazing. Saker Falcon, Lesser-white Footed Goose and Asian Houbara.	25km from 400MW

Name	Size	Designation	Notable Habitats and Species	Proximity to Project
Zarafshan State Nature Reserve	2,666 Ha	Key Biodiversity Area (KBA Partnership)	Floodplains and riparian forest (Tugay). Sub-species of Common pheasant (*Phasianus colchicus zerafschanicus*).	30km from 11km LILO
Sarazm	4,280 Ha	Key Biodiversity Area (KBA) Important Bird Area (Birdlife)	Wetland regularly supporting breeding and migratory birds including Yellow-eyed Pigeon (*Columba eversmanni*; VU) and Saker Falcon (*Falco cherrug*; EN)	45km from 11km LILO

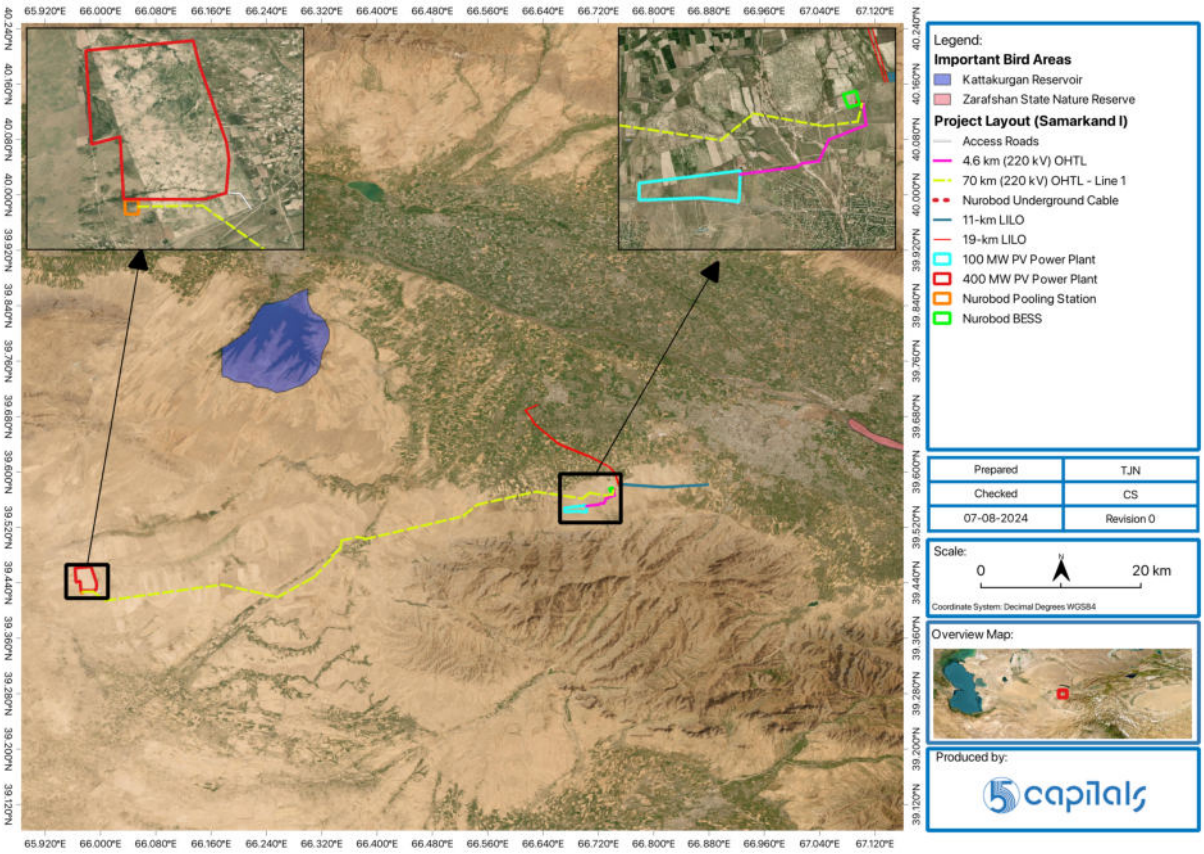


Figure 10-3 Map of KBA/IBAs and nationally protected areas near to the proposed project sites

The names and introductory information provided in this section about the various recognized areas, is portrayed here to provide spatial context about the areas surrounding the project facility footprint. These areas in some instances may play a role in the designation of sensitive

receptors, the biodiversity impact assessments, and the assessment of critical habitat. When appropriate, additional information on each recognized area (in terms of its biodiversity value and sensitivity) will be discussed within the narrative of the relevant assessment.

10.4 Ecosystems, Habitats and Plant Communities

10.4.1 Context

The study area, as delineated in the phytochorial scheme of Uzbekistan by Tojibaev et al. (2017), spans multiple phytogeographical regions across different districts and provinces, illustrating a diverse botanical landscape. These areas are distributed within both the Nuratau and Aktau regions of the Nuratau district, the Urgut region of the Kuhistan district in the Mountain Central Asian province, as well as the Chinaz and Mirzachul regions of the Middle Syrdarya district, and encompass areas within the Middle Zeravshan, Lower Zeravshan, and Karshi-Karnabchul regions of the Bukhara district in the Turan province.

The photovoltaic (PV) site for 400 MW, is located within the Karshi-Karnabchul region of the Bukhara district of the Turan province. Meanwhile, the 100 MW PV project, along with the Nurabad BESS areas, are found within the Urgut region of the Kuhistan district of the Mountain Central Asian province.

In the study area's plains, anthropogenic landscapes are prevalent, with only minor exceptions of somewhat disturbed natural ecosystems. The piedmont and low mountain regions exhibit a mix of both natural and anthropogenic landscapes. The flora and vegetation of the Tashkent, Dzhizak, and Samarkand Regions have been extensively documented in various publications. However, the botanical diversity of the Syrdarya Region remains underexplored. A general analysis of available publications and online resources indicates that the study area encompasses a vast and diverse range of flora and vegetation.

10.4.2 Study Effort

Initially, a regional botanical literature review was prepared to review existing records and identify the most suitable seasons and methods to utilize to assess the botanical and habitat typologies of the study area.

The field research within the project area was conducted through established botanical survey methods aimed at sampling and mapping vegetation, identifying floristic composition, and understanding the spatial distribution of plant communities. These methods are grounded in the foundational works on Field Geobotany (1959–1976), methodologies by Granitov (1980), and modernized approaches discussed by Kent (2011).

10.4.3 Survey Method

Sampling Method

To analyze vegetation structure and species composition, a number of geobotanical sample plots (SPs) of 50x50 m were utilized. A breakdown of these SP's, survey dates and the associated Project components are shown in the table below.

Table 10-3 Project component and number of associated sample plots

Project Component	Number of sample plots	Survey Dates
100 MW Solar PV Plant	5 (2023) 2 (2024)	July 29th 2023 March 16th 2024
400 MW Solar PV Plant	3 4	July 29th 2023 March 16th and April 6th 2024
70 km OTL	11 5	September 8th 2023 March 16th and April 6th 2024
Nurobod BESS	1 2	July 29th 2023 March 16th 2024
4.9km LILO	0 (referred to 2 BESS SPs) 1	Summer 2023 16th March 2024
11km LILO	0 3	Summer 2023 16th March 2024
19km LILO	0 3	Summer 2023 16th March 2024

These SPs were strategically located in zones of homogeneous vegetation, representative of the overall project site, and distanced from any external disturbances such as roads and the boundaries of different vegetation communities (with the coordinates of these boundaries being separately documented). Each SP was extensively documented through digital photography, and a comprehensive dataset was recorded, including GPS coordinates, elevation, topography, soil characteristics, vegetation state and disturbance factors (e.g., grazing), plant associations, canopy cover and height, species presence, their cover, abundance, phenological stages, and height. Notably, areas with significant variation (microcomplexes) and the coordinates, numbers, and spread of populations of endemic, threatened, or alien species were meticulously recorded.

Plant Associations and Vegetation Classification

Plant associations were classified according to the International Code of Phytosociological Nomenclature (2019), with a focus on the composition of dominant species. The broader vegetation types and formations adhered to the classifications provided in the "Vegetation cover of Uzbekistan" (1971–1984).

Species Cover and Abundance Scales

The quantification of species cover and abundance was executed using the Braun-Blanquet scale (1965) for detailed assessments and the DACFOR scale for rapid visual evaluations. The Braun-Blanquet scale includes six gradations, ranging from "+", indicating a low number of individuals with less than 1% coverage, to "5", where coverage exceeds 75%. The DACFOR scale categorizes plant abundance into six levels: Dominant (D), Abundant (A), Common (C), Frequent (F), Occasional (O), and Rare (R).

IDENTIFICATION AND CLASSIFICATION OF PLANT SPECIES

Plant species observed during the field survey were identified utilizing specialized references, including the "Conspectus Florae Asiae Mediae" (1968-2016), various volumes of the "Flora of Uzbekistan" (1941-1963, 2016, 2017, 2019, 2022), and specimens from the National Herbarium of Uzbekistan (TASH). The official scientific nomenclature was aligned with global taxonomic standards as outlined by the International Plant Names Index (IPNI), the Global Biodiversity Information Facility (GBIF), and Plants of the World Online (POWO).

ALIEN AND THREATENED SPECIES IDENTIFICATION

For the identification of alien species, resources such as publications by Nikitin (1983), the IUCN/ISSG (2014), and CABI (2017), along with the work of Sennikov et al. (2018), were consulted. The assessment of threatened species was based on the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009, 2019) and the IUCN Red List. Currently, only 289 out of more than 4380 species documented in Uzbekistan's flora have been evaluated by the IUCN, accounting for 6.6% of the flora. Of these, 27 species are listed as threatened on the IUCN Red List (7 Critically Endangered [CR], 10 Endangered [EN], 10 Vulnerable [VU]), with 17 also included in the national red list. Additionally, 12 species are considered Near Threatened (NT), 227 are of Least Concern (LC), and 23 fall under the Data Deficient (DD) category. A significant portion of Uzbekistan's flora remains Not Evaluated (NE) by the IUCN.

RED DATA BOOK OF UZBEKISTAN

Since its inception, five editions of the Red Data Book of Uzbekistan have been published, documenting national categories of threatened plants. These editions show a progressive increase in the number of listed species, from 163 in the first edition (1984) to 314 in the latest (2019). These categories correlate with the IUCN Red List designations, ranging from species considered probably extinct (EX or EW) to those that are endangered (CR), rare (EN), or vulnerable/declining (VU or NT).

HABITAT CLASSIFICATION FOR CONSERVATION

Following the IFC Performance Standard 6 (PS6 and GN6, 2019)), habitats are categorized into modified, natural, and critical types, each defined by the level of human impact and the

presence of native or non-native species. Critical habitats, in particular, are identified based on criteria outlined by the IUCN, including the significance to endangered species, endemic or restricted-range species, support for migratory/congregatory species, representation of unique ecosystems, or areas associated with key evolutionary processes. Numerical thresholds for these criteria are established by IUCN standards, assessing factors like the number of mature individuals, area of occupancy, and genetic diversity, among others, to gauge conservation priorities and actions.

10.4.4 Summary of Results

The following sub-sections detail the area-specific methodology and findings via an overview summary for conciseness.

10.4.5 100 MW PV Plant and Access Road Sites

10.4.5.1 Methodology

The botanical survey for the 100 MW PV Plant was conducted in Summer 2023 and Spring 2024. In 2023, a total of 5 quadrats of 50x50m were surveyed on 29th July, which covered the facility footprint itself and the surrounding area (Plots 34-38).

In 2024, on 16th March, two additional survey quadrats of 50x50m were sampled (Plots 5 and 6). Sample Plot 5 was located within the 100MW Plant footprint, approximately 2.5 km to the west of the village Sazagan, whilst sample Plot 6, fell just outside the facility boundary.

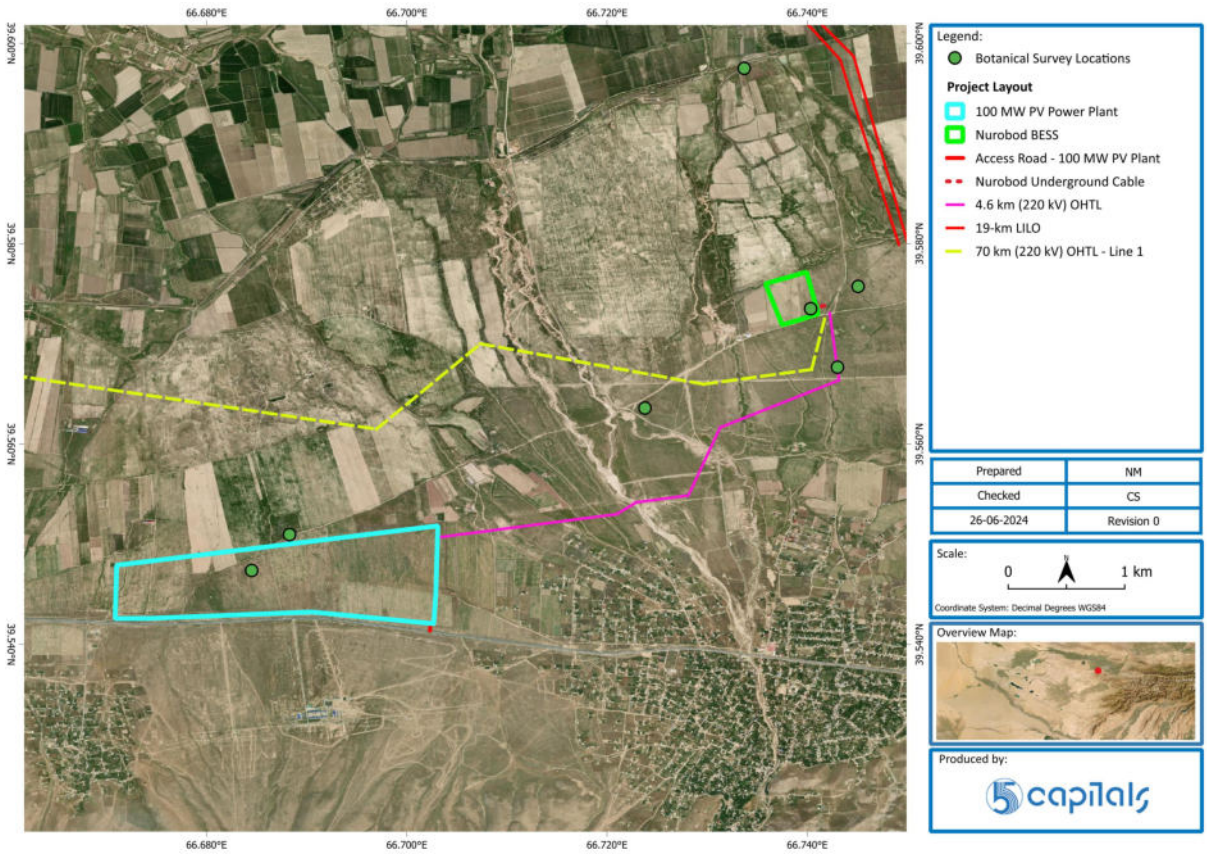


Figure 10-4 The second round of botanical surveys conducted in spring 2024 for the 100 MW PV Plant

Table 10-4 Habitat survey sample locations at 100MW PV Plant

SP No.	Season/Year	Date	Latitude, N	Longitude, E
34	Summer 2023	29 Jul	39.55423	66.69496
35	Summer 2023	29 Jul	39.5462	66.69512
36	Summer 2023	29 Jul	39.55146	66.68727
37	Summer 2023	29 Jul	39.54724	66.68084
38	Summer 2023	29 Jul	39.54687	66.67097
Plot 5	Spring 2024	16 Mar	39.547369	66.6845
Plot 6	Spring 2024	16 Mar	39.550955	66.688282

10.4.5.2 Results – Habitats and Communities

During habitat surveys of the Facility footprint and surrounding area, four habitat types were recorded; Arable Land, Fallow Land, Fruit Gardens and Vineyards, and Dry Grassland. The footprint of the 100MW Plant itself is largely characterised by Fallow Land with some discrete areas of Arable land (Figure 1 6), whilst the other noted habitats were recorded within the AoI. Each habitat type is discussed in more detail below.

Table 10-5 Habitat Classifications

Habitat	Classification	Notes
Arable Land	Modified	Rainfed land used for wheat, barley and safflower
Fallow Land	Modified	Abandoned non irrigated or rainfed arable land
Fruit Gardens and Vineyards	Modified	Plantations and rural gardens dominated by woody and fruit tree species
Dry Grasslands	Natural	Native temperate grasslands; boundary strips in between fields and unploughed land

Figure 10-5 Habitat types observed within the 100 MW PV Plant footprint

Arable Lands

Within the 100 MW Photovoltaic (Samarkand 1 PV Plant I) plant area and its vicinity, the habitat identified falls under the IUCN habitat type 14 Artificial – Terrestrial, specifically subtype 14.1 Arable Land. This classification aligns with the EUNIS habitat type V Vegetated man-made habitats, further categorized into subtype V1 Arable land and market gardens (V11 Intensive unmixed crops). This particular section of the landscape is dedicated to rainfed arable farming, where cultivation does not rely on irrigation but rather on natural rainfall.

The crops grown in this habitat include:

- Wheat (*Triticum aestivum*);

- Barley (*Hordeum vulgare*);
- Safflower (*Carthamus tinctorius*);

These rainfed arable lands represent a significant adaptation to the local climate and soil conditions, allowing for the cultivation of crops that are particularly suited to the environmental conditions present. This method of farming underscores the integration of agricultural practices within the natural water cycle of the region, highlighting an approach to land use that relies on the natural precipitation patterns rather than supplemental irrigation.

FALLOW LANDS

Fallow Lands are categorized under the IUCN habitat type 14 Artificial – Terrestrial, specifically subtype 14.2 Pasture Land. This classification is echoed in the EUNIS habitat type V Vegetated man-made habitats, with a particular focus on subtype V1 Arable land and market gardens (V15 Bare tilled, fallow or recently abandoned arable land). Such lands, previously subjected to either irrigated or rainfed agricultural use, have been left unattended and are now characterized by the emergence of secondary vegetation communities.

These communities comprise a diverse array of species, including:

- Grasses such as Bromus scoparius, B. tectorum, Hordeum murinum ssp. leporinum, H. spontaneum, Cynodon dactylon, Elymus repens, and Poa bulbosa;
- Annual and perennial weeds including *Artemisia annua, A. scoparia, Atriplex micrantha, Capsella bursa-pastoris, Descurainia sophia, Centaurea iberica, C. solstitialis, Cirsium vulgare, Carthamus oxyacanthus, Echinophora sibthorpiana, Lepidium latifolium, Xanthium spinosum, and X. strumarium;*
- Saltworts such as *Caroxylon dendroides and Suaeda altissima;*
- Caper *(Capparis spinosa)* and camel thorn *(Alhagi pseudalhagi)*.

The variability in species composition, abundance, and canopy cover across different fallow lands is significantly influenced by local environmental conditions, including soil type, salinity, humidity, and other factors. This variation underscores the dynamic nature of fallow lands as transitional habitats that can evolve over time based on natural succession processes and changing environmental conditions.

Fallow lands serve as crucial ecological niches, providing habitat for a wide range of flora and fauna while also contributing to the biodiversity of agricultural landscapes.

SURROUNDING HABITATS INFLUENCED BY THE PROJECT AREA

In addition to the previously mentioned habitats, the surroundings of the 100 MW Photovoltaic (Samarkand 1 PV Plant I) project area, within its area of influence, feature both a type of modified habitat and a type of natural habitat.

FRUIT GARDENS AND VINEYARDS

In the vicinity of the 100 MW Photovoltaic (Samarkand 1 PV Plant I) project area, particularly around the village Sazagan and nearby farmhouses, there exists a number of Fruit Gardens and Vineyards, representing a type of modified habitat. Classified under the IUCN habitat type 14 Artificial – Terrestrial, specifically subtypes 14.3 Plantations and 14.4 Rural Gardens, this area is aligned with the EUNIS classification as habitat type V Vegetated man-made habitats, including subtypes V5 Shrub plantations (V54 Vineyards) and V6 Tree dominated man-made habitats (V61 Broadleaved fruit and nut tree orchards).

The agricultural landscape is distinguished by:

- Plantations of fruit trees, predominantly apple (*Malus domestica*), with the inclusion of apricot (*Prunus armeniaca*) and peach (*Prunus persica*) varieties;
- Rural gardens that are carefully fenced and often bordered by poplars (*Populus afghanica, P. alba*), willows (*Salix excelsa*), elms, and mulberry trees (*Morus alba*), creating a lush perimeter;
- Intercrops of alfalfa (*Medicago sativa*) and a variety of vegetables such as potatoes (*Solanum tuberosum*), tomatoes (*Lycopersicon esculentum*), and onions (*Allium cepa*), which are cultivated between the rows of fruit trees, enriching the soil and diversifying the produce;
- The presence of wild grasses and weeds along the garden ditches and fences, contributing to the biodiversity of the area and offering habitat for numerous small fauna.

DRY GRASSLANDS

The Dry Grasslands within and around the areas of influence, such as the Ettitepa Archaeologic Heritage site, are categorized under IUCN habitat type 4 Native grassland, specifically subtype 4.4 Temperate grassland. This is mirrored by the EUNIS habitat classification as type R Grasslands and lands dominated by forbs, mosses or lichens, specifically subtype R1 Dry grasslands. Located in transitional zones such as boundary strips between fields, along rugged terrains, dry beds of temporary streams, and hill areas, these habitats are critical for the biodiversity of the region.

Vegetation in these grasslands includes:

- Ephemeroids like *Poa bulbosa* and *Carex pachystylis*;
- Annual grasses such as *Aegilops cylindrica, Ae. triuncialis, Bromus tectorum, Hordeum murinum subsp. leporinum, and Taeniatherum caput-medusae*;
- Xerophytic forbs including camel thorn (*Alhagi pseudalhagi subsp. kirghisorum), caper (Capparis spinosa), Phlomis thapsoides, and Cousinia resinosa.*

These species are indicative of ephemeral-ephemeroid vegetation (*Agrillophyta or Ephemerophyta*), prevalent across serozem soils (*Calcic xerosols*) found on the piedmont

plains and foothills of Uzbekistan. This habitat supports a variety of life and is commonly utilized by local communities as pasture land.

However, the presence of spiny forbs and certain poisonous species such as *Peganum harmala, Sophora pachycarpa, and Diarthron vesiculosum* points to significant ecological stresses, chiefly attributable to overgrazing. This overuse reflects in varying degrees of canopy cover, ranging from 20–30% to 50–60%, and suggests a high level of habitat degradation.

No threatened plants listed on global or national Red Lists were identified in the field survey, indicating that while the habitat faces challenges, it may not currently be home to critically endangered species. Nonetheless, the dry grasslands play a vital role in the ecosystem, supporting a diverse array of flora and fauna and contributing to the landscape's ecological balance. Conservation efforts in these areas are crucial for maintaining biodiversity and ecosystem health.

10.4.5.3 Results – Flora Species

Within the area of the 100 MW Photovoltaic (Samarkand 1 PV – Plant I) project, the summer-autumn 2023 botanical surveys have documented a diverse range of plant species, summarized as follows:

- **Total Plant Species Recorded:** 70 species were identified, with the number of species varying across different sample plots, ranging from 24 to 67 species. This highlights the ecological richness and heterogeneity of the vegetation within the project area.
- **Conservation Status:** None of the species recorded are listed on national or globally red lists, indicating that they are not considered at risk of extinction at these levels.
- **Alien Species:** 13 species identified are classified as alien, meaning they are not native to the region and have been introduced from elsewhere. Additionally, the area includes 2 agricultural crops, wheat (Triticum aestivum) and barley (Hordeum vulgare).
- **Life Cycle Diversity:** The plant species diversity includes 37 annuals (completing their life cycle within one year), 7 biennials (living for two years, typically flowering in the second year), 24 perennials (living for several years and usually flowering each year), and 1 subshrub (a woody plant with low-growing, perennial shoots).
- **Ecological Context:** All species recorded are characteristic of and fairly common within the piedmont plains and foothills of Uzbekistan. This reflects the typical biodiversity of the region. Notably, the prevalence of therophytes (annuals and biennials) underscores the presence of secondary ephemeral-grass and ephemeral-forb-grass communities, particularly on fallow lands. This trait is indicative of the ecological dynamics in Uzbekistan, where such plant communities play a crucial role in the succession and stabilization of disturbed soils.

Within the area of the 100 MW Photovoltaic (Samarkand 1 PV – Plant I) project, the Spring 2024 botanical survey further documented the diversity of plant species, providing detailed insights as follows:

- **Total Plant Species Recorded:** The Spring 2024 survey observed 95 distinct species across various sample plots, emphasizing the complex ecological diversity present within the project area. Species distribution varied significantly across the plots, highlighting the ecological richness and heterogeneity of the vegetation.
- **Conservation Status:** Consistent with previous findings, none of the species identified during the Spring 2024 survey are listed on national or international red lists, indicating that they are not considered at risk of extinction at these levels.
- **Alien Species:** The survey identified 16 alien species, which are not native to the region and have been introduced from other areas. This count includes new alien species detected in the latest survey, underscoring the ongoing monitoring and assessment of non-native flora intrusion.
- **Life Cycle Diversity:** The plant life forms recorded in the Spring 2024 survey include 43 annuals, completing their life cycle within one year; 9 biennials, typically flowering in the second year; 39 perennials, which live for several years and usually flower each year; and 2 subshrubs, which are woody plants with low-growing, perennial shoots.
- **Ecological Context:** The species documented are characteristic of the piedmont plains and foothills typical to Uzbekistan, illustrating the region's native biodiversity. The survey particularly noted the increased prevalence of secondary ephemeral-grass and ephemeral-forb-grass communities, especially on fallow lands. These communities are essential in the ecological dynamics of Uzbekistan, contributing to the succession and stabilization of disturbed soils.

10.4.6 Nurobod BESS and Underground Cable Sites

10.4.6.1 Methodology

The botanical survey for the Nurobod BESS facility was conducted across two visits, in Summer 2023 and Spring 2024. Due to the size and homogeneity of the site, one location was chosen to perform a 50x50m^2 flora quadrat (Plot 33), surveyed on 29th July 2023.

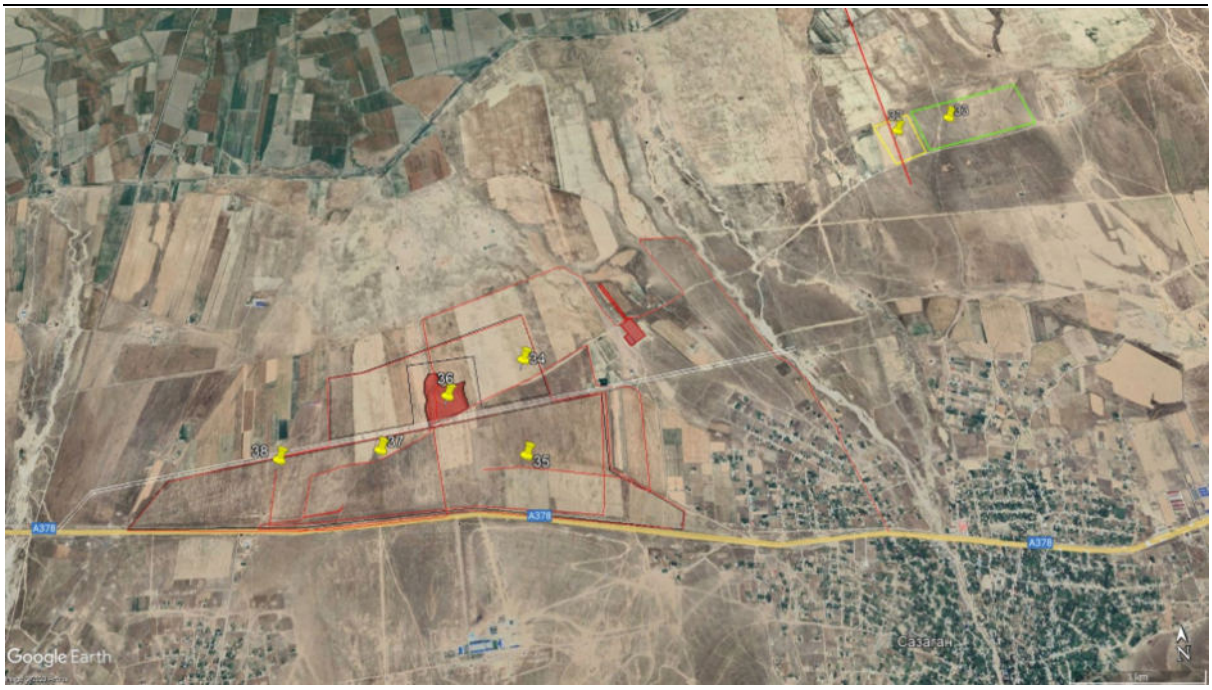


Figure 10-6 Botanical Survey Efforts. Survey track (red line) and sample plots in the areas of Nurabad BESS

In Spring 2024 a second round of botany surveys were completed. On 16th March 2024, two additional survey quadrats of 50x50m^2 were sampled, one within the Nurobod BESS footprint (SP1) and one covering the proposed Nurobod access road (SP4).

Figure 10-7 The second round of botanical surveys conducted in spring 2024 for the Nurobod BESS (polygon; Sample Plot 1), and access road (white line; Sample Plot 4), situated in Nurobod District

Table 10-6 Habitat survey sample locations at Nurobod BESS

SP No.	Season/Year	Date	Latitude, N	Longitude, E	Elevation, m.s.l.
34	Summer 2023	29 Jul	39.57559	66.74406	n/a
Plot 5	Spring 2024	16 Mar	39.575733	66.745086	n/a
Plot 6	Spring 2024	16 Mar	39.563586	66.723789	n/a

10.4.6.2 Results – Habitats and Communities

Across the Nuobod BESS site and access roads, two habitat types were identified during combined 2023 and 2024 surveys; Fallow Land and Dry Grassland.

Table 10-7 Habitat Classification

HABITAT	CLASSIFICATION	NOTES
Fallow Land	Modified	Abandoned non-irrigated arable land with sandy-clayey soil. Characterized by ephemeral vegetation primarily due to grazing and ground roads.
Dry Grassland and Dry Bed of Temporary Stream	Natural	Native vegetation including camel thorn and ephemerals. Impacted by grazing and pollution with garbage.

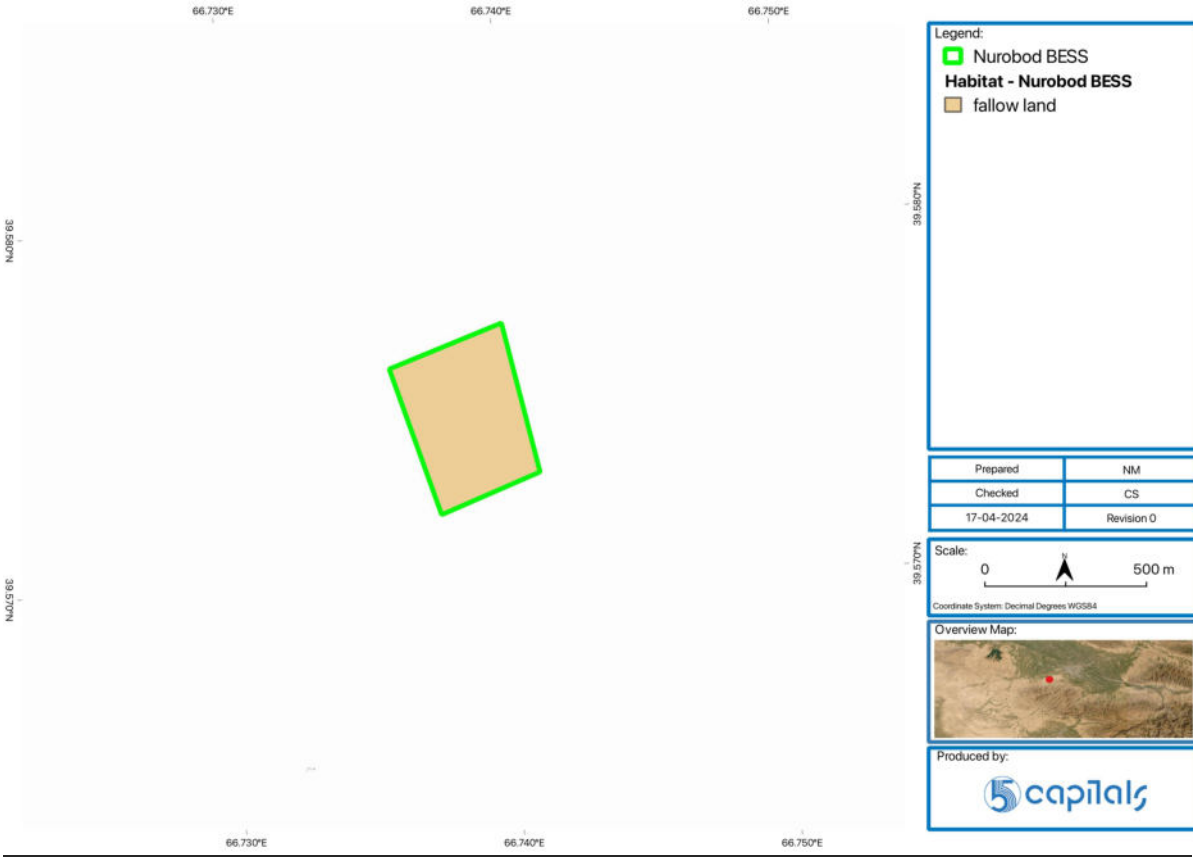


Figure 10-8 Map of habitats within the Nurobod BESS site

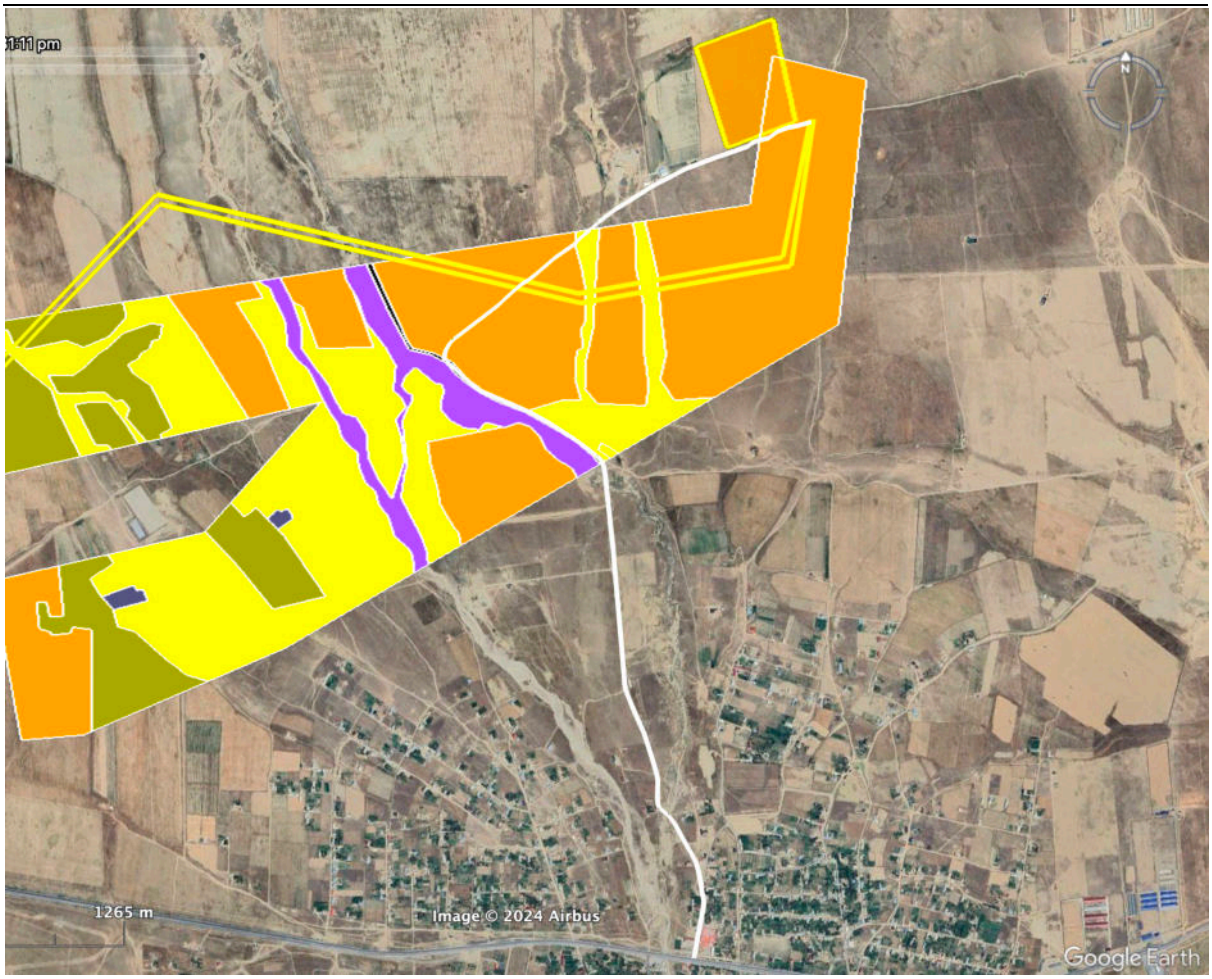


Figure 10-9 Habitat types identified during the 2024 botanical survey for the Nurobod BESS and access road (white line). Fallow land = Orange; Dry Grassland = Yellow; Dry Bed of Temporary Stream = Purple.

FALLOW LANDS

The first round of botany surveys focused solely on the Nurobad BESS footprint and identified just one habitat type, Fallow Lands, discussed in more detail below.

Fallow Lands are designated under the IUCN habitat type 14 Artificial – Terrestrial, incorporating both subtypes 14.1 Arable Land and 14.2 Pasture Land. This classification is in line with the EUNIS habitat type V Vegetated man-made habitats, specifically subtype V1 Arable land and market gardens (V15 Bare tilled, fallow or recently abandoned arable land). These lands represent areas once under cultivation that have been left idle and are not currently used for active farming, leading to a natural process of ecological succession or regeneration.

Characteristics of these fallow lands include:

- Soils that are a mix of sandy and clayey textures;
- Vegetation comprising communities of bluegrass (Poa bulbosa), camel thorn (*Alhagi pseudalhagi subsp. kirghisorum*), with occasional harmel (*Peganum harmala*) and *Cousinia resinosa*;

The vegetation on these lands is typically sparse and irregular, with plants scattered or forming small patches. The species composition is generally poor, reflecting the transitional nature of the habitat and possibly the varying degrees of soil fertility, moisture, and other environmental conditions that affect plant growth.

Despite the lack of intensive cultivation, these areas are utilized by local communities as pasture lands, indicating their importance in the local agrarian economy and for livestock grazing. The condition of the fallow lands, from nearly 0 to 20% canopy cover, underscores the need for careful management to prevent soil degradation and promote biodiversity conservation within these transitional habitats.

DRY GRASSLANDS & DRY BED OF TEMPORARY STREAMS

Based on the Spring 2024 botanical survey, the habitat classifications were expanded to include additional natural and modified habitats surrounding the Nurobod BESS, and the associated access roads.

Dry Grasslands are typically found on gentle foothills and are marked by low, sparse vegetation predominantly composed of hardy grass species that can withstand the arid climate. This habitat is crucial for the conservation of soil and prevention of erosion.

Dry Bed of Temporary Streams are habitats marked by the presence of seasonal water channels that support a unique set of flora adapted to fluctuating moisture levels, often serving as critical corridors for wildlife during dry periods.

Dry Grasslands and Dry Bed Temporary Streams are newly identified natural habitats located along the access road. These habitats are found on gentle foothills and along the dry beds of temporary streams that crisscross the planned route towards the A378 highway.

Fallow Lands continue to overlap significantly with the Nurobod BESS, and access road areas, representing lands formerly cultivated but now left idle, undergoing natural succession. The Settlement class, characterized by small residential areas and associated infrastructures, overlaps with the access road near the A378 highway. Farmsteads, located along the access road, include small agricultural plots and buildings integral to local agrarian activities.

10.4.6.3 Results – Flora Species

For the Battery Energy Storage System (BESS), botanical surveys conducted in summer-autumn 2023 have yielded findings, collectively summarized as follows:

- **Total Plant Species Recorded:** 25 species were identified in the vicinity of each site, with the species composition being consistent across both locations.
- **Conservation Status:** None of the species recorded are listed on national or globally red lists, indicating that they are not considered at risk of extinction at these levels.

- **Alien Species:** 3 species identified are classified as alien, meaning they are not native to the region and have been introduced from elsewhere.
- **Life Cycle Diversity:** The plant species diversity includes 14 annuals (completing their life cycle within one year), 2 biennials (living for two years, typically flowering in the second year), and 9 perennials (living for several years and usually flowering each year).
- **Ecological Context:** All species recorded are indicative of the flora typically found within the piedmont plains and foothills of Uzbekistan, an area characterized by rainfed crops and fallow lands. This suggests that the plant communities in these areas are reflective of the broader regional ecosystem, adapted to the specific climatic and soil conditions prevalent in these piedmont and foothill zones.

Based on the Spring 2024 botanical survey data, the updated findings for the areas (including access road) and Battery Energy Storage System (BESS) site are summarized as follows:

- **Total Plant Species Recorded:** The Spring 2024 survey documented a variety of species, with 29 distinct species identified across multiple sample plots. This represents an increase in biodiversity compared to the previous survey and highlights the varying species composition across different locations.
- **Conservation Status:** Similar to earlier findings, none of the species recorded during the Spring 2024 survey are listed on national or globally red lists, confirming that they are not considered at risk of extinction at these levels.
- **Alien Species:** No new alien species were identified in the Spring 2024 survey, maintaining the count at three species that are not native to the region and have been introduced from elsewhere.
- **Life Cycle Diversity:** The plant species diversity includes a mix of annuals, perennials, and biennials. Specifically, there are 15 annuals, 11 perennials, and 3 biennials, illustrating a dynamic range of plant life cycles that reflect adaptations to the local climatic and soil conditions.
- **Ecological Context:** The flora recorded in the Spring 2024 survey continues to be indicative of the piedmont plains and foothills typical of Uzbekistan. This region's characteristics include rainfed crops and fallow lands, which are reflected in the plant communities. Notable species include Camel Thorn (Alhagi pseudalhagi), Desert Madwort (Alyssum desertorum), and Bulbous Bluegrass (Poa bulbosa), each adapted to the specific conditions of the surveyed sites.

10.4.7 70-km OTL

10.4.7.1 Methodology

The botanical survey for the 70km OTL was conducted, across two seasons Autumn (2023) and Spring (2024). In 2023, 11 50x50m^2 quadrats were surveyed on 8th September, which covered the length of the 70km OTL (Plots 45-55). This examination was guided by the frameworks provided by the IUCN Habitats Classification Scheme and the EUNIS habitat classification.

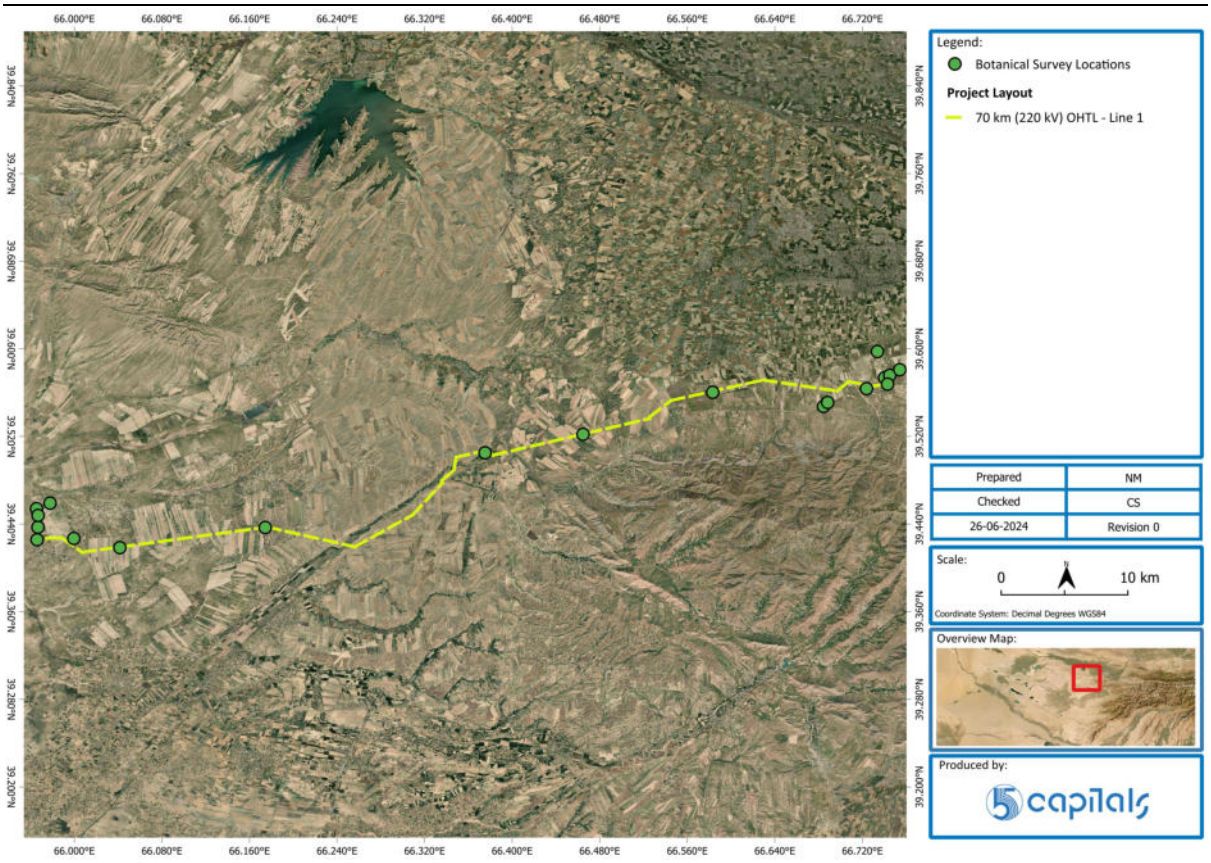


Figure 10-10 Survey map. Sample plots during the summer-autumn 2023 survey in the area of 70 km OTL (Nurabad District of Samarkand Region)

In the Spring 2024 botanical survey conducted along the 70 km stretch of the Overhead Transmission Line (OTL) and related project sites, detailed examinations were carried out on five specifically chosen sample plots. These plots (SP15, SP18, SP19, SP20, and SP21), were surveyed on 2 separate days; SP15 was surveyed on 16 March 2024, whereas SP18 to SP21 were surveyed on 6 April 2024. The spring 2024 sample plots were selected to represent a range of habitat types impacted by project developments. Each plot was surveyed with a focus on capturing the ecological variations across the region and assessing the effects of infrastructural activities on local biodiversity.

This survey was guided by the frameworks provided by the IUCN Habitats Classification Scheme and the EUNIS habitat classification, ensuring a structured and comprehensive environmental assessment. The locations of these plots span different environmental settings, from natural dry grasslands to modified agricultural lands, reflecting the diverse ecological backdrop of the area. This approach provides a robust basis for understanding the habitat dynamics and informs the ongoing conservation and management strategies for the region.

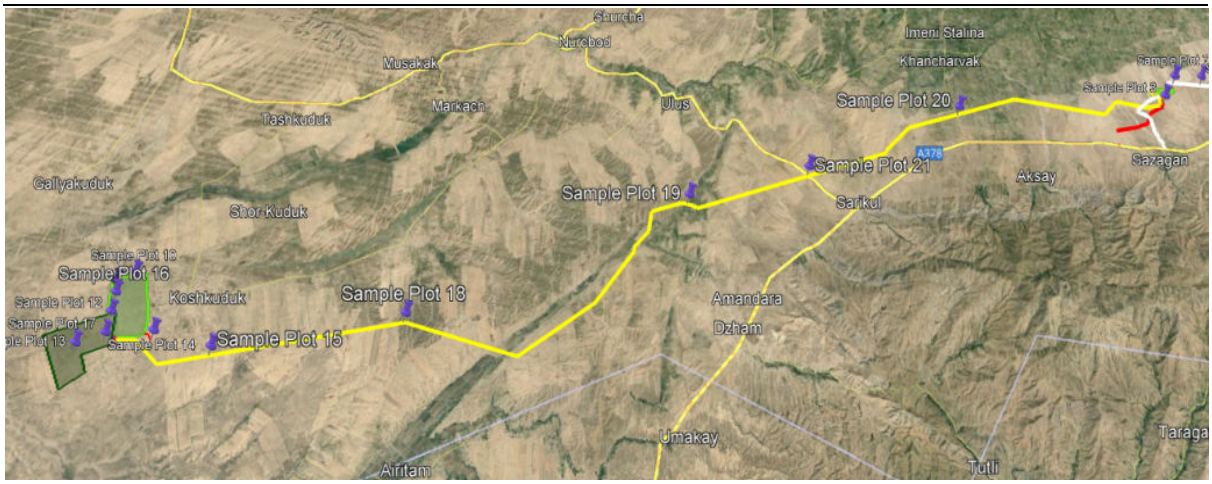


Figure 10-11 Survey map. Sample plots during the spring 2024 survey in the area of 70 km OTL (Nurabad District of Samarkand Region)

During the Spring 2024 botanical survey on 16 March and 6 April, sample plot SP 15 was located 2.5 km south of Koshkuduk village in the Nurobod District of Samarkand Region. SP 18 was found 3 km south of Urtabuz village in the same region, and SP 19 was positioned along the bank of the Eski Anhor canal in Nurobod District. Each location was chosen for its unique environmental characteristics and proximity to significant infrastructural developments.

Table 10-8 Sample locations for the parallel 70 km OTLs corridor surveys in summer-autumn 2023

SP No.	Location	Date	Latitude, N	Longitude, E	Elevation, m.s.l.	Habitat type	Canopy cover, %	Number of species
45	Nurobod District of Samarkand Region	08.09.2023	39.5656, 66.719		745	natural (Dry bed of temporary stream)	20-30	13
46	Nurobod District of Samarkand Region	08.09.2023	39.5615, 66.7027		740	natural (Dry grassland) + modified (Arable lands with non-irrigated agricultural crops)	15-20	19
47	Pastdargom District of Samarkand Region, 5 km to the southeast of village	08.09.2023	39.5678, 66.6516		725	modified (Vineyard; Boundary-strips, roadsides; Canals and	80-90	45

SP No.	Location	Date	Latitude, N	Longitude, E	Elevation, m.s.l.	Habitat type	Canopy cover, %	Number of species
	Khancharvak					drainage channels)		
48	Pastdargom District of Samarkand Region, 3 km to the south of village Khancharvak	08.09.2023	39.5678	66.6134	710	modified (Arable lands with irrigated agricultural crops; Boundary-strips, roadsides; Canals and drainage channels)	70-80	45
49	Pastdargom District of Samarkand Region, 2 km to the south of village Khancharvak	08.09.2023	39.5607	66.5832	707	modified (Fruit garden; Boundary-strips, roadsides)	20-30	32
50	Nurobod District of Samarkand Region, 2.5 km to the northwest of the village Sarikul	08.09.2023	39.5218	66.4648	692	natural (Dry grassland)	Oct-15	10
51	Nurobod District of Samarkand Region, left bank of the canal Moskow	08.09.2023	39.5072	66.4024	600	natural (Dry grassland) + modified (Canal)	0-5	12
52	Nurobod District of Samarkand Region	08.09.2023	39.4927	66.3137	542	natural (Dry grassland)	Oct-15	13
53	Nurobod District of Samarkand Region	08.09.2023	39.4893	66.299	550	natural (Dry grassland)	Oct-15	6
54	Nurobod District of Samarkand Region, 1.5	08.09.2023	39.4145	66.0103	416	natural (Dry grassland)	0-5	7

SP No.	Location	Date	Latitude, N	Longitude, E	Elevation, m.s.l.	Habitat type	Canopy cover, %	Number of species
	km to the south of the village Koshkuduk							
55	Nurobod District of Samarkand Region, 0.8 km to the southwest of the village Koshkuduk	08.09.2023	39.4229	65.9943	410	natural (Dry grassland)	0-10	7

Table 10-9 Sample plots checklist for the parallel 70 km OTLs corridor surveys in spring 2024

SP No.	Season/Year	Date	Latitude, N	Longitude, E	Elevation, m.s.l.
45	Autumn 2023	08 Sep	39.5656,	66.719	745
46	Autumn 2023	08 Sep	39.5615	66.7027	740
47	Autumn 2023	08 Sep	39.5678	66.6516	725
48	Autumn 2023	08 Sep	39.5678	66.6134	710
49	Autumn 2023	08 Sep	39.5607	66.5832	707
50	Autumn 2023	08 Sep	39.5218	66.4648	692
51	Autumn 2023	08 Sep	39.5072	66.4024	600
52	Autumn 2023	08 Sep	39.4927	66.3137	542
53	Autumn 2023	08 Sep	39.4893	66.299	550
54	Autumn 2023	08 Sep	39.4145	66.0103	416
55	Autumn 2023	08 Sep	39.4229	65.9943	410
15	Spring 2024	16 Mar	39.418412	66.041455	366
18	Spring 2024	06 Apr	39.56149	66.174337	482
19	Spring 2024	06 Apr	39.507245	66.40238	660
20	Spring 2024	06 Apr	39.560228	66.5832	707
21	Spring 2024	06 Apr	39.52184	66.464766	682

10.4.7.2 Results – Habitats and Communities

The following table provides an overview of habitats identified within the site.

Table 10-10 Habitat Classification

HABITAT	CLASSIFICATION	NOTES
Arable Land	Modified	Irrigated and rainfed arable land,
Fallow Land	Modified	Abandoned irrigated or rainfed arable land
Fruit Gardens and Vineyards	Modified	Plantations and rural gardens dominated by woody and fruit tree species
Boundary strips, roadsides, canals and drainage channels	Modified	narrow strips between the fields, along the roads and irrigation systems.
Dry Grasslands	Natural	Unploughed areas with more or less rugged terrain
Dry beds of temporary streams	Natural	Narrow strips along dry beds of several rather large temporary streams

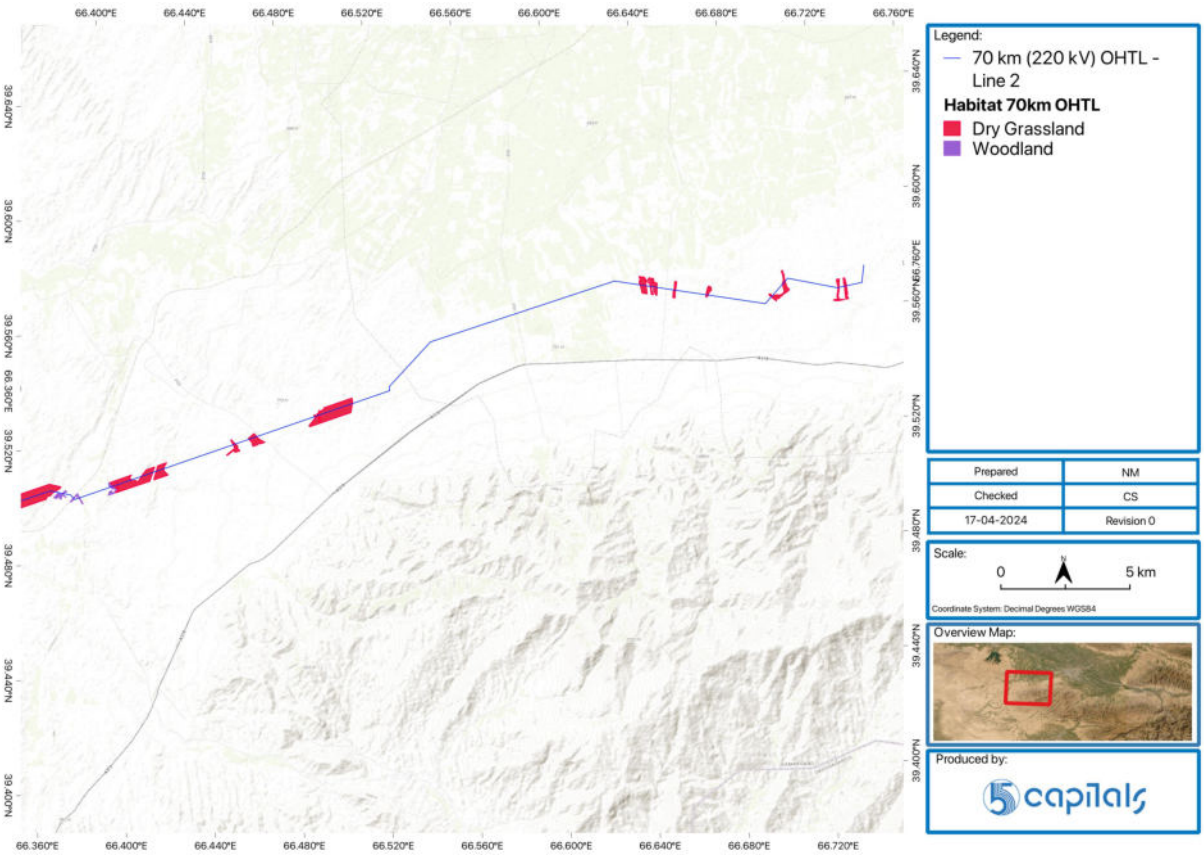


Figure 10-12 Habitat types - OTL 70 km

The sample plots (SPs) surveyed in autumn 2023 illustrate a diverse array of habitats ranging from natural dry grasslands and dry beds of temporary streams, to various types of modified

landscapes including vineyards, arable lands, and fruit gardens. Notably, these SPs capture the ecological variance across the Nurobod and Pastdargom Districts of the Samarkand Region, characterized by a gradient of canopy cover percentages and species diversity.

SPs 45 and 46, located in the Nurobod District, feature natural habitats with modest canopy cover and species counts, highlighting dry beds of temporary streams and grasslands juxtaposed with non-irrigated agricultural lands. These plots, with canopy covers ranging from 15-20% to 20-30%, support up to 19 species, reflecting the semi-arid nature of the region.

In contrast, SPs 47 to 49 in the Pastdargom District near the village of Khancharvak reveal more intensively modified habitats with significantly higher canopy coverage (70-90%) and species diversity (up to 45 species). These areas, encompassing vineyards, arable lands with irrigated crops, and fruit gardens, showcase the region's agricultural practices and the ecological complexity within managed landscapes.

Further into the Nurobod District, SPs 50 to 55 underscore the predominance of natural dry grasslands, with the exception of SP 51 which incorporates a modified canal habitat. These plots, particularly SPs 54 and 55 near the village of Koshkuduk, display minimal canopy cover (0-10%) and lower species counts (up to 13 species), indicative of the arid conditions and sparse vegetation typical of the district's lower elevations.

Across these SPs, no species listed on the IUCN or UzbRDB Red Lists were identified, suggesting that while these habitats are diverse and indicative of the region's ecological breadth, they may not currently be under significant threat from conservation standpoints. Nonetheless, the variety in habitat types, canopy cover, and species diversity underscores the ecological richness of the Samarkand Region's landscapes traversed by the 70 km OTHL corridor.

ARABLE LANDS WITH AGRICULTURAL CROPS

Arable Lands with Agricultural Crops within the 70 km Overhead Transmission Line (OTL) corridor are characterized under the IUCN habitat type 14 Artificial – Terrestrial, specifically subtype 14.1 Arable Land. This classification corresponds to the EUNIS habitat type V – Vegetated man-made habitats, and is detailed further into subtype V1 Arable land and market gardens (V11 Intensive unmixed crops), with certain areas also fitting into subtype V14 Inundated or inundatable croplands, which includes rice fields. This broad habitat category is differentiated into two distinct subtypes based on irrigation practices: irrigated arable lands and non-irrigated (rainfed) arable lands.

In the region encompassed by the 70 km OTHL, particularly in the eastern sections near villages such as Khancharvak and Kyzylkarvan, irrigated arable lands are primarily dedicated to the cultivation of cotton (*Gossypium hirsutum*), wheat (*Triticum aestivum*), and peanut (Arachis

hypogaea). These areas represent a relatively small portion of the land, highlighting focused agricultural production within this specific zone.

Conversely, non-irrigated arable lands, which rely on natural rainfall rather than artificial irrigation, are predominantly used for growing wheat and barley (Hordeum vulgare). This approach to agriculture is identified as the main form of modified habitat along the 70 km OTHL, indicating a significant reliance on rainfed farming practices within the area.

The division between irrigated and non-irrigated arable lands illustrates the diverse agricultural strategies employed within the OTHL's area of influence. This distinction not only reflects the varied water resource management practices but also underscores the adaptation of farming techniques to local environmental conditions.

FRUIT GARDENS AND VINEYARDS

In the eastern sector of the 70 km Overhead Transmission Line (OTL) corridor, particularly around the villages of Khancharvak and Kyzylkarvan, Fruit Gardens and Vineyards represent a distinct habitat type, albeit covering relatively modest areas. These are categorized under IUCN habitat type 14 Artificial – Terrestrial, with the subtypes 14.3 Plantations and 14.4 Rural Gardens. The EUNIS habitat classification mirrors this, recognizing it as habitat type V – Vegetated man-made habitats, specifically subtypes V5 Shrub plantations (V54 Vineyards) and V6 Tree dominated man-made habitats (V61 Broadleaved fruit and nut tree orchards).

The habitat is characterized by:

- **Fruit gardens**, which consist of orchards planting primarily apple (Malus domestica) and apricot (Prunus armeniaca) trees. These gardens serve as a significant source of local fruit production.
- **Vineyards**, dedicated to cultivating grapevine (Vitis vinifera), contribute both to the agricultural diversity and the local economy through wine production or fresh grape sales.

The areas surrounding these plantations and vineyards are noted for their rich biodiversity, including wild grasses and weeds that flourish along the water ditches and field margins. This vegetation not only supports a variety of wildlife but also plays a role in soil conservation and water management within the agricultural landscape.

These managed habitats of fruit gardens and vineyards highlight the integration of agricultural practices into the natural landscape, providing essential ecosystem services such as pollination and habitat for various species. Furthermore, they reflect the cultural and economic importance of agriculture in the areas adjacent to the OTL, underlining the need for sustainable management practices that support both biodiversity conservation and agricultural productivity.

FALLOW LANDS

Fallow Lands within the area surveyed, identified under the IUCN habitat type 14 Artificial – Terrestrial, specifically subtype 14.2 Pasture Land, align with the EUNIS habitat type V Vegetated man-made habitats, further categorized into subtype V1 Arable land and market gardens (V15 Bare tilled, fallow or recently abandoned arable land). These segments of land, once used for irrigated or rainfed agricultural practices, now host a variety of secondary vegetation, marking a transition phase in land use from active cultivation to a more dormant state, awaiting potential future agricultural activities or natural succession.

The vegetation characterizing these fallow lands includes:

- **Grasses:** Such as *Bromus scoparius, B. tectorum, Hordeum murinum ssp. leporinum, H. spontaneum, Cynodon dactylon,* and *Poa bulbosa*;
- **Annual and Perennial Weeds:** Including *Centaurea iberica, C. solstitialis, Cirsium vulgare, Carthamus oxyacanthus, Echinophora sibthorpiana*, and *Xanthium spinosum*;
- **Other notable species:** Caper (*Capparis spinosa*) and camel thorn (*Alhagi pseudalhagi*).

The variation in species composition, abundance, and the density of canopy cover across these lands is influenced by several factors, including soil type, humidity, and the age of fallow land, along with other local environmental conditions. This variability highlights the dynamic nature of fallow lands as ecosystems in transition, capable of supporting a diverse array of plant species and serving as interim habitats that contribute to the biodiversity of the area.

BOUNDARY-STRIPS, ROADSIDES, CANALS, AND DRAINAGE CHANNELS

Boundary-Strips, Roadsides, Canals, and Drainage Channels represent an ecologically important habitat type found within the surveyed area, marked by narrow strips that bisect fields, meander along roads, and flank irrigation systems. These habitats are categorized under the IUCN habitat type 14 Artificial – Terrestrial, specifically subtypes 14.1 Arable Land and 14.2 Pasture Land, which closely align with the EUNIS habitat type V – Vegetated man-made habitats. Within this broad classification, they are further distinguished by subtypes V38 Dry perennial anthropogenic herbaceous vegetation and V39 Mesic perennial anthropogenic herbaceous vegetation, highlighting the diversity of plant life adapted to these transitional zones.

The vegetation that thrives in these areas includes:

- Camel thorn (*Alhagi pseudalhagi*) and Persian rose (*Rosa persica*), adding color and structure to these strips;

- A variety of **annual and perennial grasses** such as *Aegilops cylindrica, Ae. triuncialis, Bromus scoparius, B. tectorum, Hordeum murinum ssp. leporinum, Cynodon dactylon*, and *Poa bulbosa*, which form the green backbone of these habitats;
- **Weeds** including *Centaurea iberica, C. solstitialis, Sophora alopecuroides*, *Sophora pachycarpa*, and *Xanthium spinosum*, which, despite their label, contribute to the biodiversity and ecological resilience of the area.

Moreover, the banks of irrigation and drainage canals host oleaster (*Elaeagnus angustifolia*), tamarisk (*Tamarix* sp.), reed (*Phragmites australis*), along with other mesophytic plants such as *Mentha longifolia* var. *asiatica* and *Epilobium hirsutum*, creating lush, verdant corridors that not only support a wide range of wildlife but also play a crucial role in soil stabilization and water filtration.

The diversity in species composition, abundance, and canopy cover across these habitats varies significantly depending on local conditions, illustrating the adaptability of plant communities to the human-modified landscapes. These boundary areas serve as vital green spaces that enhance connectivity between habitats, support wildlife, and contribute to the overall ecological health of the region.

DRY GRASSLANDS

Dry Grasslands represent a crucial natural habitat classified under IUCN habitat type 4 Native grassland, specifically subtype 4.4 Temperate grassland. This classification aligns with the EUNIS habitat type R Grasslands and lands dominated by forbs, mosses or lichens, and particularly subtype R1 Dry grasslands. These grasslands are typically found in unplowed areas that feature rugged terrain, such as the dry beds of temporary streams and hillsides.

The vegetation within these habitats includes a variety of species:

- Ephemeroids like *Poa bulbosa* and *Carex pachystylis*;
- Annual grasses such as *Aegilops cylindrica, Ae. triuncialis, Bromus tectorum, Hordeum murinum subsp. leporinum*, and *Taeniatherum caput-medusae*;
- Xerophytic forbs including camel thorn (*Alhagi pseudalhagi subsp. kirghisorum*), caper (*Capparis spinosa*), *Phlomis thapsoides*, and *Cousinia resinosa*;

These species are indicative of the ephemeral-ephemeroid vegetation (Agrillophyta or Ephemerophyta), which is widespread across the serozem soils (Calcic xerosols) found on the piedmont plains and foothills of Uzbekistan. This habitat is commonly utilized by local communities as pasture land.

The presence of spiny forbs and the noted degradation levels, primarily due to overgrazing, point to significant ecological challenges. Canopy cover in these areas is relatively sparse, with coverage of 20–30% or less, highlighting the pressures faced by this habitat, including the risk of erosion and loss of biodiversity.

Despite these pressures, threatened plants listed on global or national Red lists were not identified in the field survey, suggesting that while the habitat faces degradation, it may not currently be the site of critically endangered species. Nonetheless, the dry grasslands serve a vital role in the local ecosystem, supporting a range of plant and animal life and contributing to the biodiversity of the region.

DRY BEDS OF TEMPORARY STREAMS

Dry Beds of Temporary Streams within the eastern segment of the 70 km Overhead Transmission Line (OTL) area are characterized as EUNIS habitat type H – Inland unvegetated or sparsely vegetated habitats. This specific habitat encompasses narrow strips along the courses of what are, during certain times of the year or under specific conditions, several rather large temporary streams.

The vegetation within these dry stream beds is notably sparse, primarily consisting of:

- Tamarisk (*Tamarix spp.*);
- Camel thorn (*Alhagi pseudalhagi*);
- Along with various other annual and perennial plant species that have adapted to the harsh conditions of these intermittently dry environments.

The habitat faces moderate to strong degradation pressures, largely attributable to gravel extraction activities. This form of land use significantly impacts the soil structure, hydrology, and overall ecological function of the habitat, leading to a reduction in biodiversity and the disruption of natural processes.

Despite the sparse vegetation, these areas are crucial ecological niches, providing habitat for specialized species that can tolerate the extreme conditions of dry riverbeds. The presence of such habitats within the project area underlines the diverse ecological landscape traversed by the OTL and highlights the importance of considering a wide range of environmental impacts and conservation needs in infrastructure development and land use planning.

10.4.7.3 Results – Flora Species

Along the Parallel 70 km Overhead Transmission Line (OTHL), a comprehensive botanical survey carried out in summer-autumn 2023 documented a total of 76 plant species. Key findings from this survey include:

- **Conservation Status:** None of the recorded species are listed on national or globally red lists, indicating no immediate conservation concerns for these plants within this specific area.
- **Alien Species:** Among the flora, 15 species are identified as alien weeds, highlighting the presence and potential impact of non-native species within the ecosystem.

- **Agricultural Crops:** Four species are recognized as agricultural crops integral to the local economy, including wheat (Triticum aestivum), cotton (Gossypium hirsutum), peanut (Arachis hypogaea), and alfalfa (Medicago sativa).
- **Cultivated Trees and Shrubs:** Additionally, four species of cultivated fruit or ornamental trees and shrubs were noted, such as apple (Malus domestica) and grapevine (Vitis vinifera), underscoring the diversity of plant life managed within the area.
- **Life Cycle Diversity:** The plant community is composed of 31 annuals, 7 biennials, 34 perennials, and 1 subshrub, demonstrating a broad range of life cycles adapted to the local environmental conditions.
- **Ecological Context:** All species are typical for the piedmont plains and foothills of Uzbekistan, with the species recorded per sample plot ranging from 6 to 45. The variance in species richness across plots indicates different levels of ecological succession and habitat quality, with natural and secondary communities in xeric (dry) natural and modified habitats showing a more uniform species composition. In contrast, mesic (moderately moist) modified habitats display greater diversity, enriched by the presence of both native and alien weeds.

Along the Parallel 70 km Overhead Transmission Line (OTHL), a comprehensive botanical survey carried out in spring 2024 using 5 sample points (SP15, SP18-SP21) documented a total of 118 plant species. Key findings from this survey include:

- **Conservation Status:** Most species recorded are not listed on national or globally red lists, with the majority classified under the 'NE' (Not Evaluated) category by the IUCN, indicating there are no immediate conservation concerns for these plants within these areas.
- **Alien Species:** The flora includes a notable presence of alien species such as 'Capsella bursa-pastoris' (Shepherd's-purse) and 'Xanthium spinosum' (Bathurst burr), which highlights the ongoing impact and potential threat of non-native species within these ecosystems.
- **Agricultural Crops:** Several species are recognized as agricultural crops, playing a vital role in the local economy. These include 'Malus domestica' (Apple) and 'Triticum aestivum' (Bread Wheat), which dominate in sample plot SP 20 and SP 21, respectively.
- **Cultivated Trees and Shrubs:** The survey noted the presence of cultivated trees such as 'Malus domestica' (Apple) in SP 20, indicating the influence of human management and landscape modification on the local flora.
- **Life Cycle Diversity:** The species composition across the plots shows a diverse range of life cycles, including annuals like 'Bromus tectorum' (Wall Brome), biennials such as 'Centaurea iberica' (Iberian knapweed), numerous perennials like 'Carex pachystylis' (Thick-stem sedge, desert sedge), and subshrubs such as 'Rosa persica' (Persian rose).
- **Ecological Context:** The plant communities across the sample plots are typical for the semiarid regions of Central Asia, with variations in species richness indicating different

levels of ecological succession and habitat quality. The presence of both native and alien species across different moisture regimes from xeric to mesic habitats suggests a dynamic interplay between natural plant communities and those influenced by human activity.

10.4.8 4.9-km OTL Sites

10.4.8.1 Methodology

Detailed flora surveys were not conducted within the 4.9 km footprint of the Overhead Transmission Line (OTL) during the summer-autumn 2023 survey. However, due to their proximity and the similarities in habitat types, data from comprehensive botanical surveys of the adjacent Nurobod BESS and surroundings, surveyed on 29 July 2023, were used to understand flora assemblages in the area (Plots 32 and 33).

The figure below highlights the proximity of the 4.9km OTL footprint to the Nurobod BESS facility and associated survey point.

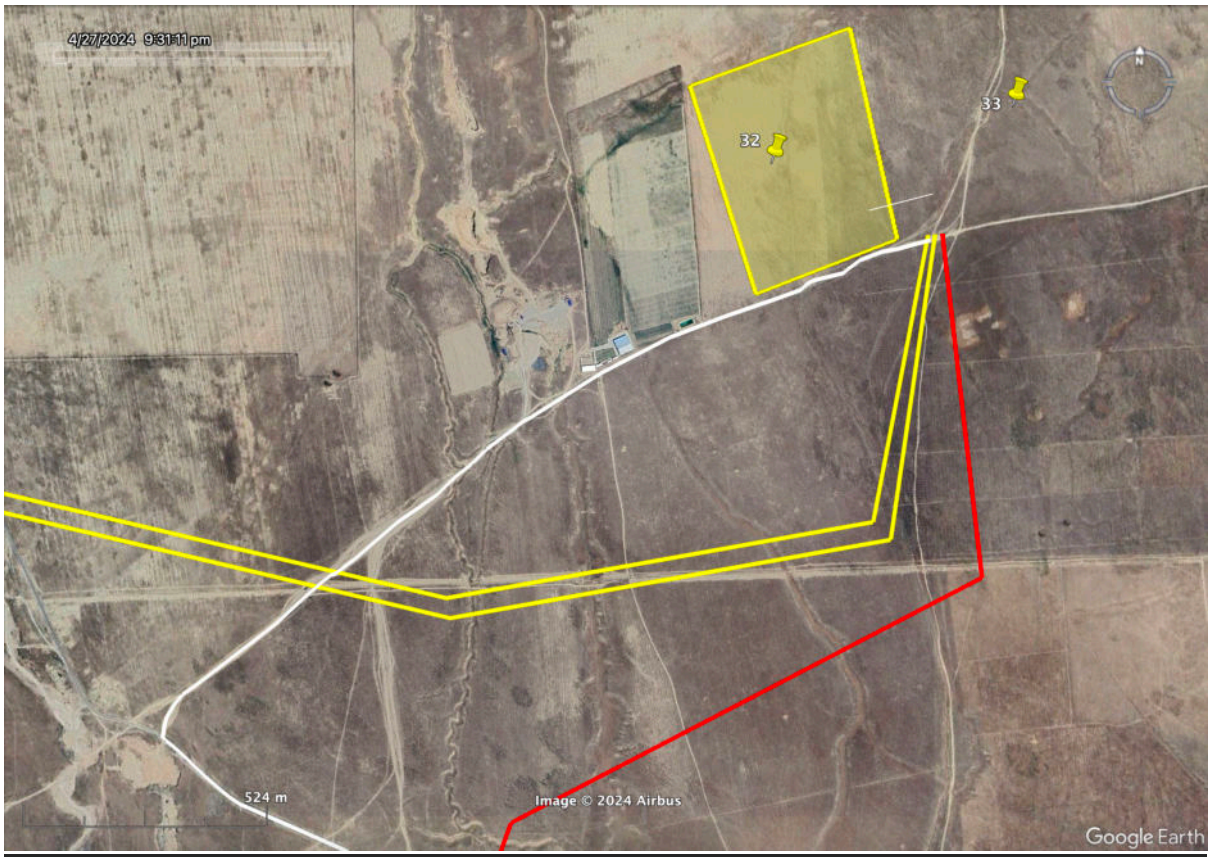


Figure 10-13 Proximity of 4.9km OTL (Red line) to Nurobod BESS facility (yellow polygon).

During the spring 2024 botanical survey, conducted on 16th March, included one sample plot (SP 3 – 50x50 m^2) for the 4.9 km OTL line.

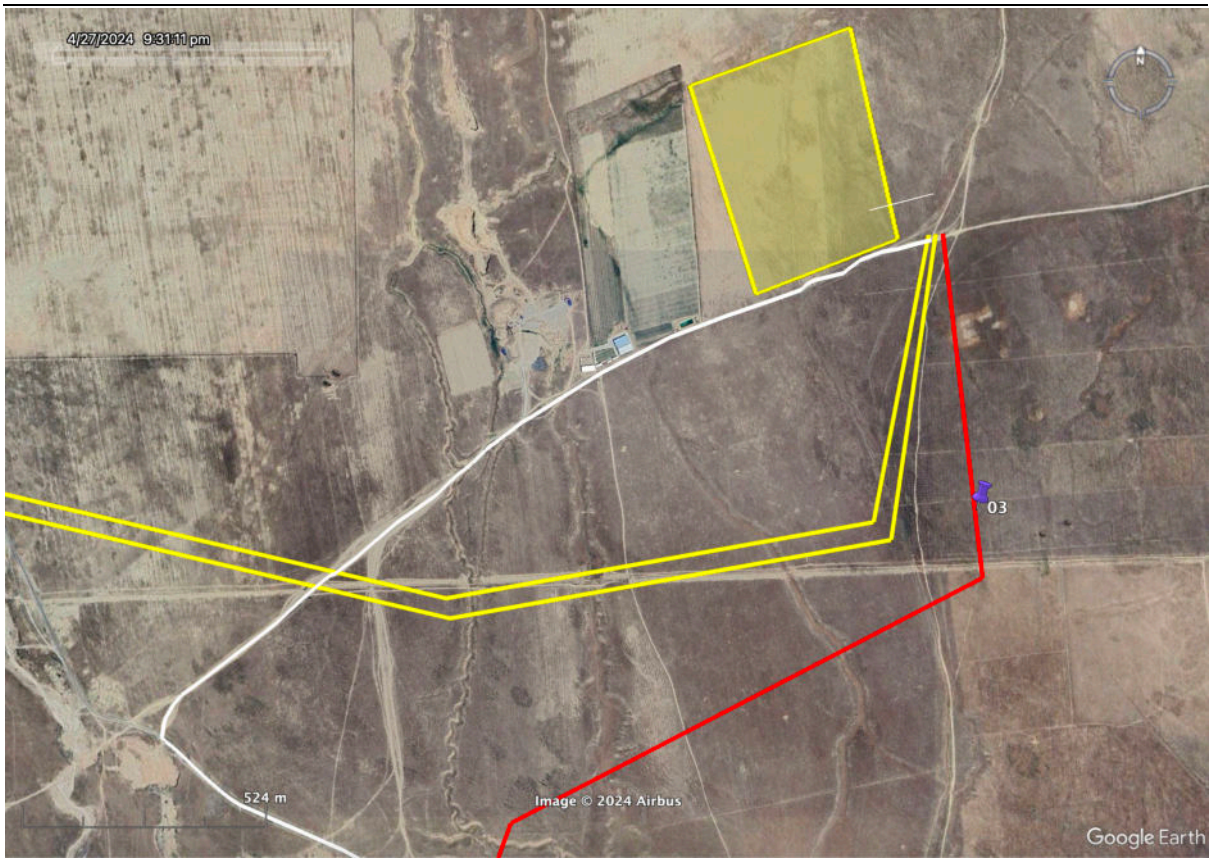


Figure 10-14 Botany survey sample plot for 4.9km OTL

This survey was guided by the frameworks provided by the IUCN Habitats Classification Scheme and the EUNIS habitat classification, ensuring a structured and comprehensive environmental assessment. The locations of these plots span different environmental settings, from natural dry grasslands to modified agricultural lands, reflecting the diverse ecological backdrop of the area. This approach provides a robust basis for understanding the habitat dynamics and informs the ongoing conservation and management strategies for the region.

10.4.8.2 Results – Habitats and Communities

Along the 4.9km OTL, 2 types of natural habitat and 2 types of modified habitat were recorded, as shown in the following table.

Table 10-11 Habitat Classification

HABITAT	CLASSIFICATION	NOTES
Arable Land	Modified	Rainfed land used for wheat, barley and safflower
Fallow Land	Modified	Abandoned non irrigated arable land with sandy-clayey soil
Dry Grasslands	Natural	Unploughed areas with more or less rugged terrain
Dry beds of temporary streams	Natural	Narrow strips along dry beds of several rather large temporary streams

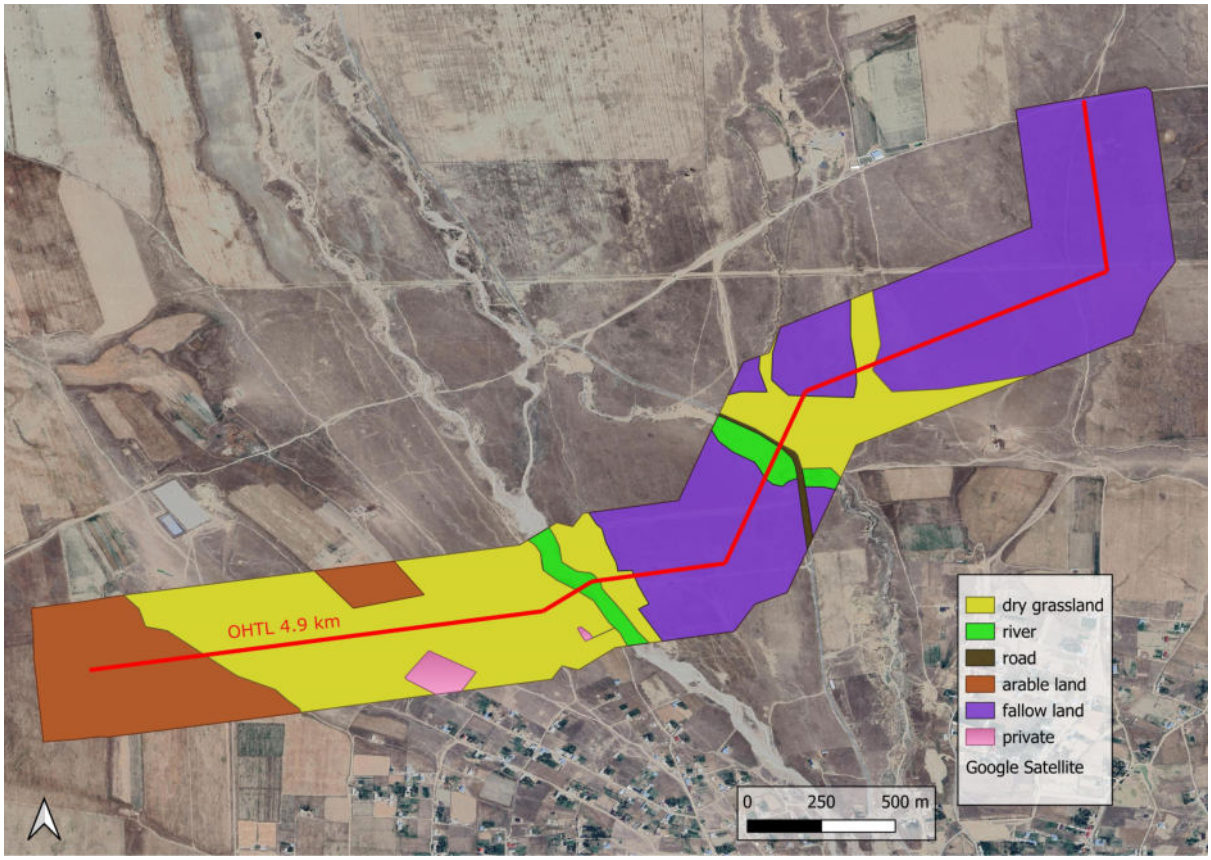


Figure 10-15 Habitat types - OTL 4.9 km

ARABLE LANDS WITH AGRICULTURAL CROPS

Within the vicinity of the 100 MW Photovoltaic (Samarkand 1 PV - Plant I) facility and its surrounding areas, Arable Lands with Agricultural Crops are a prominent feature, designated under the IUCN habitat type 14 Artificial – Terrestrial, specifically subtype 14.1 Arable Land. This categorization is echoed in the EUNIS habitat type V Vegetated man-made habitats, detailed further into subtype V1 Arable land and market gardens (V11 Intensive unmixed crops). This landscape is dominated by rainfed arable lands, where agriculture relies on natural precipitation rather than artificial irrigation.

The crops cultivated in this habitat include:

- Wheat (Triticum aestivum),
- Barley (Hordeum vulgare),
- Safflower (Carthamus tinctorius).

These rainfed arable lands illustrate a critical aspect of agricultural practice in the area, emphasizing the reliance on seasonal rainfall to support crop growth.

FALLOW LANDS

Fallow Lands are designated under the IUCN habitat type 14 Artificial – Terrestrial, specifically including subtypes 14.1 Arable Land and 14.2 Pasture Land. This classification is matched by the EUNIS habitat type V Vegetated man-made habitats, more precisely subtype V1 Arable land and market gardens (V15 Bare tilled, fallow or recently abandoned arable land). These lands, once cultivated and now left idle, are characterized by a mix of sandy and clayey soils, supporting a distinct vegetation community.

The primary species found in these fallow lands include:

- Bluegrass (*Poa bulbosa*),
- Camel thorn (*Alhagi pseudalhagi subsp. kirghisorum*),
- Harmel (*Peganum harmala*),
- *Cousinia resinosa*.

Vegetation is typically sparse, with plants distributed in scattered patches, indicating a relatively poor species composition. The presence of these specific plants suggests a landscape in transition, possibly recovering from previous agricultural use or awaiting future cultivation. Currently, these areas serve as pasture lands for local communities, highlighting their continued value in the local agrarian economy despite the cessation of active farming.

The management of fallow lands presents an opportunity for ecological restoration and biodiversity enhancement. Through strategic planning, these areas can serve multiple functions, contributing to sustainable agricultural practices, supporting local livelihoods, and preserving native flora and fauna.

DRY GRASSLANDS

Dry Grasslands are recognized under the IUCN habitat type 4 Native grassland, specifically subtype 4.4 Temperate grassland, and align with the EUNIS habitat classification as type R Grasslands and lands dominated by forbs, mosses or lichens, subtype R1 Dry grasslands. These habitats are typically found in boundary strips between fields, on unplowed lands with rugged terrains, along the dry beds of temporary streams, and on hillsides, embodying a crucial component of the region's ecological diversity.

Vegetation within these dry grasslands includes a mix of:

- Ephemeroids such as Poa bulbosa and Carex pachystylis,
- Annual grasses like Aegilops cylindrica, Ae. triuncialis, Bromus tectorum, Hordeum murinum subsp. leporinum, and Taeniatherum caput-medusae,
- Xerophytic forbs including camel thorn (Alhagi pseudalhagi subsp. kirghisorum), caper (Capparis spinosa), Phlomis thapsoides, and Cousinia resinosa.

These species are indicative of ephemeral-ephemeroid vegetation (Agrillophyta or Ephemerophyta), prevalent across the serozem soils (Calcic xerosols) found on piedmont plains and foothills of Uzbekistan, highlighting the adaptability of plant life to arid conditions.

This natural habitat is commonly utilized by local communities for grazing purposes. However, the presence of spiny forbs and certain poisonous plants like Peganum harmala, Sophora pachycarpa, and Diarthron vesiculosum signals a considerable degree of habitat degradation, largely attributed to overgrazing. Canopy cover varies between 20–30% to 50–60%, reflecting varying degrees of vegetation density.

Despite the challenges posed by overgrazing, no threatened plants listed on global or national Red Lists were identified during the field survey. This underscores the resilience of dry grasslands and the necessity of implementing sustainable grazing practices to mitigate degradation and preserve these habitats for their ecological value and the livelihoods they support.

DRY BEDS OF TEMPORARY STREAMS

Dry Beds of Temporary Streams are identified along the eastern section of the 70 km Overhead Transmission Line (OTHL) area, fitting into the EUNIS habitat type H – Inland unvegetated or sparsely vegetated habitats. These areas are characterized by the dry beds of what are, periodically, rather large temporary streams.

The vegetation within these habitats is notably sparse, consisting mainly of isolated specimens of:

- Tamarisk,
- Camel thorn (*Alhagi pseudalhagi*),
- Along with a variety of other annual and perennial plants adapted to the harsh, arid conditions of these stream beds.

This habitat is currently facing moderate to severe degradation, primarily due to gravel extraction activities in the area. Such activities not only disrupt the physical structure of these habitats but also impact the local biodiversity by removing vegetation cover and altering the natural landscape.

The presence of sparse vegetation in these dry stream beds highlights their resilience and the unique ecological niche they occupy within the landscape. Despite the challenges posed by human activities, these habitats continue to support a variety of life forms adapted to extreme conditions. Conservation and sustainable management practices are essential to mitigate further degradation and ensure the preservation of these unique ecological areas.

10.4.8.3 Results – Flora Species

Based on the comprehensive botanical survey conducted along the 4.9-km OTL line during spring 2024, detailed flora data has now been compiled, providing a clear picture of the species distribution and ecological dynamics within this specific corridor. The survey documented several plant species, each adapted to the environmental conditions prevalent along this section of the OTL. Here are the updated findings reflecting the actual data collected:

- **Diversity in Species Composition:** The survey identified a diverse array of plant species including Camel Thorn, Desert Madwort, and Thick-stem Sedge, among others. This diversity highlights the varied botanical community that exists along the transmission line, indicating a rich ecological environment.
- **Habitat and Ecological Context:** The habitat types recorded along the OTL predominantly include modified fallow lands and dry grasslands, which support a mix of native flora. These areas are typical of the piedmont plains and foothills of Uzbekistan, characterized by a mixture of native and occasional alien plant species.
- **Life Cycle Diversity:** The presence of annuals, perennials, and biennials among the recorded species reflects a dynamic ecological system where different plant life cycles contribute to the overall sustainability and biological diversity of the area.
- **Conservation and Alien Species Impact:** None of the species documented in the 2024 survey are listed on national or globally red lists, suggesting there are currently no immediate conservation concerns for these plants within this corridor. However, the documentation of alien species like the occasional presence of invasive plants such as the Caper and African Rue underscores the need for ongoing monitoring and management to prevent potential impacts on the native flora.
- **Ecological Stability and Adaptation:** The consistent occurrence of certain species across multiple sample plots within the corridor, such as the Common Storks Bill and Bulbous Bluegrass, suggests that these plants are well-adapted to the environmental and ecological conditions along the OTL. This indicates a stable ecological system capable of supporting a diverse plant community.

10.4.9 400MW PV plant

10.4.9.1 Methodology

During Summer 2023 habitat surveys, a total of 3 sample plots (39-41) were surveyed within the footprint of the 400 MW PV facility on the 29th July 2023.

Table 10-12 Sample plot locations for summer 2023 habitat surveys within the 400MW PV Plant footprint

SP No.	Project site	Location	Date	Latitude, N	Longitude, E	Elevation, m.s.l.
39	400 MW PV	Nurabad District of Samarkand Region, 2.3 km to the northwest of the village Koshkuduk	29.07.2023	39.45894,	65.9849	385
40	400 MW PV	Nurabad District of Samarkand Region, 3.5 km to the west of the village Koshkuduk	29.07.2023	39.44893,	65.96658	392
41	400 MW PV	Nurabad District of Samarkand Region, 2.3 km to the west of the village Koshkuduk	29.07.2023	39.44314,	65.97621	400

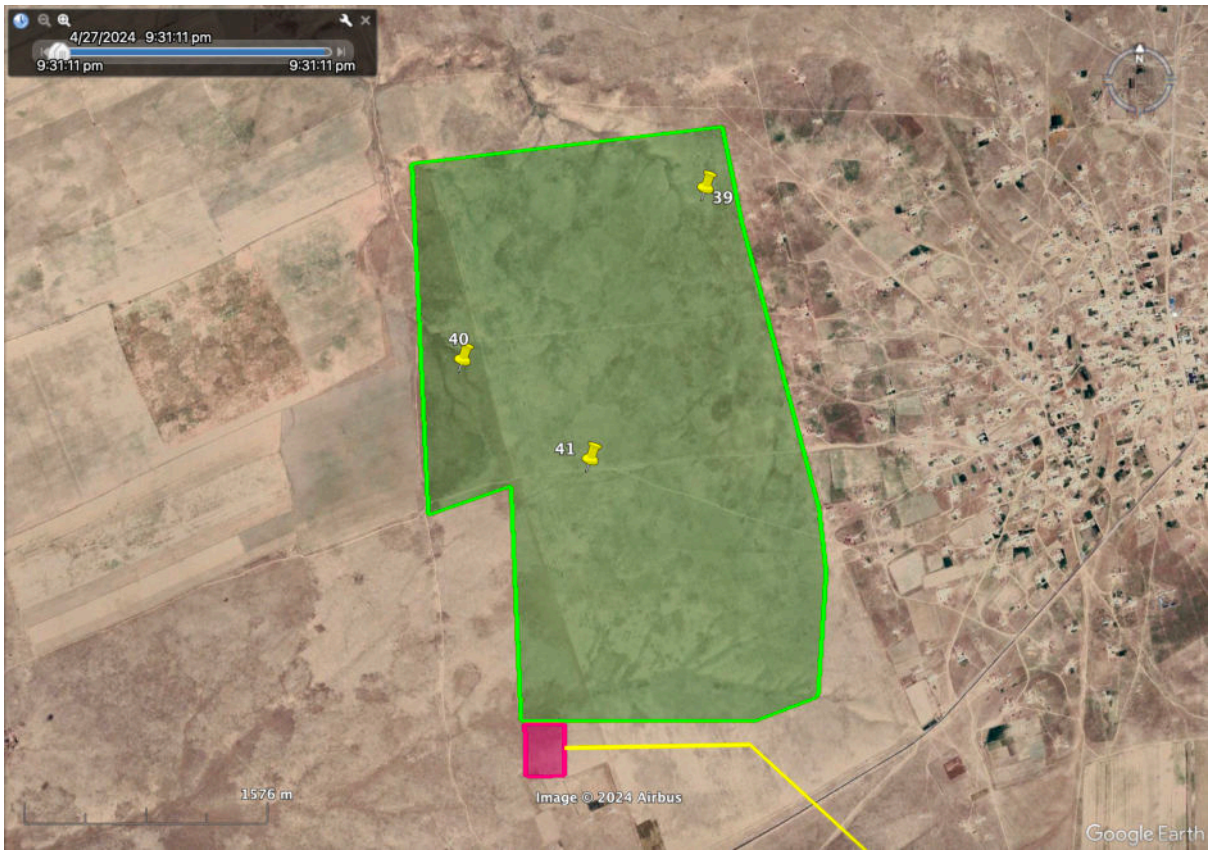


Figure 10-16 Survey map showing sample plots surveyed within the 400 MW PV footprint (Nurabad District of Samarkand Region)

During Spring 2024 surveys, 4 sample locations (10, 11, 14 and 16) were chosen within the 400 MW PV Plant footprint and access roads. Surveys were completed on 16th March 2024.

Table 10-13 Locations of survey points within the 400 MW PV Plant footprint sampled in Spring 2024

SP No.	Project Element	Location	Date	Latitude, N	Longitude, E	Elevation, m.s.l.
10	400 MW PV Footprint	Nurobod District of Samarkand Region, 1 km to the west of the village Koshkuduk	3/16/2024	39.459027	65.97769	375
11	400 MW PV Footprint	Nurobod District of Samarkand Region, 2.7 km to the west of the village Koshkuduk	3/16/2024	39.453977	65.965366	346
14	Access Road to 400 MW PV	Nurobod District of Samarkand Region, 0.3 km to the west of the village Koshkuduk	3/16/2024	39.42679	65.99937	372
16	400 MW PV Footprint	Nurobod District of Samarkand Region, 2.7 km to the west of the village Koshkuduk	4/6/2024	39.447806	65.966744	345

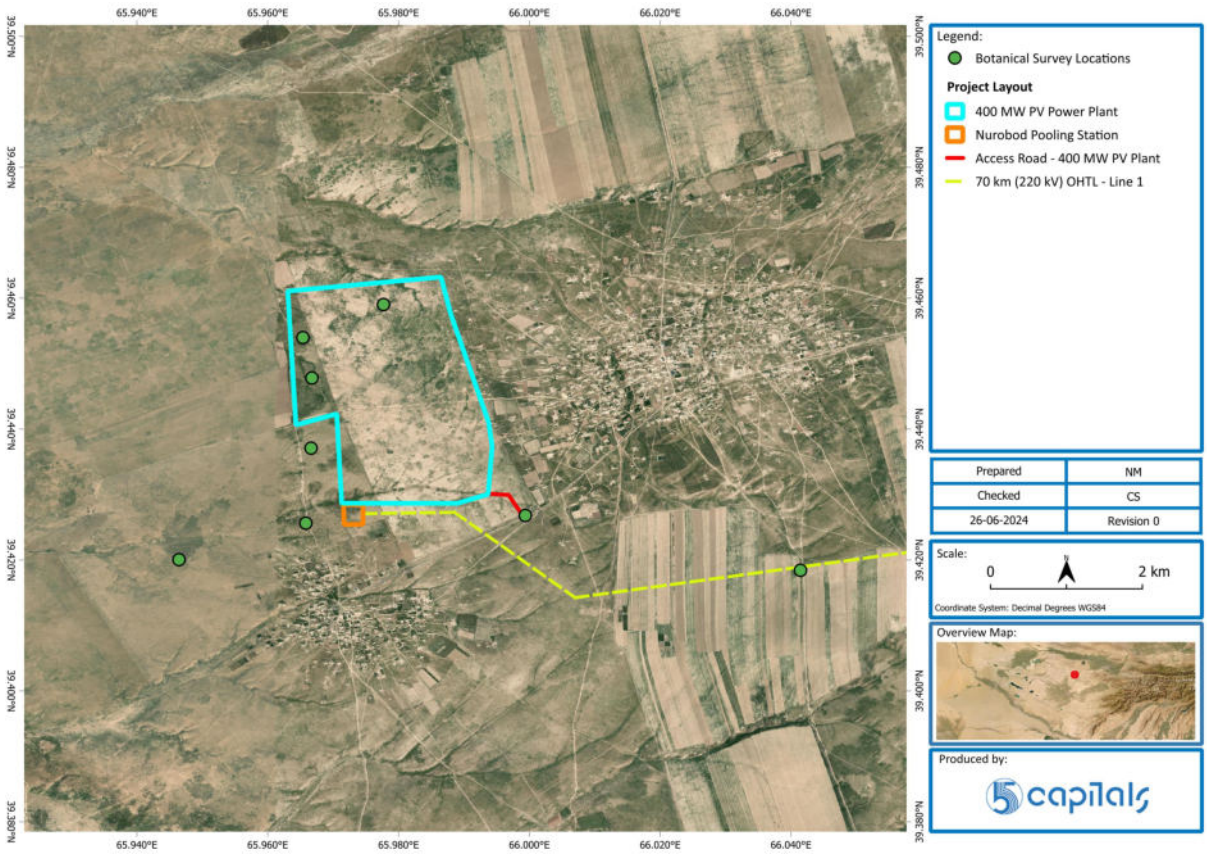


Figure 10-17 Surveyed sample plots in spring 2024 for the 400 MW PV Plant and access road (Nurabad District of Samarkand Region)

In the Nurobod District of the Samarkand Region, during the spring of 2024, a series of botanical surveys were conducted at three sample plots (SP10, SP11, SP16) associated with the 400 MW Photovoltaic (PV) Plant project. These surveys reveal notable variations in habitat types and plant diversity, reflecting the complex ecological dynamics near the project site. The specific characteristics of each plot are summarized as follows:

Sample plot 10, positioned 1 km west of the village Koshkuduk, is found in modified fallow lands with a canopy cover of 30-40%. This plot supports 16 species, highlighting a transition zone where previously cultivated land is undergoing ecological succession. The relatively high canopy cover for a fallow land indicates some successful regrowth and recovery of plant life.

Sample plot 11, located 2.7 km west of Koshkuduk, falls within natural dry grassland. This site has a canopy cover of 30-40% and hosts 20 species. The dry grassland here is relatively intact and showcases a stable and diverse plant community typical of the region's semi-arid conditions. This plot exemplifies how undisturbed natural habitats support greater biodiversity.

Sample plot 16, also located at 2.7 km west of Koshkuduk but surveyed later on April 6, 2024, shares its location with SP11 but features a denser canopy cover of 50-60% and contains 22 species. The higher density and species count suggest excellent ecological health and resilience, providing a robust habitat for a variety of native plants.